This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

GOVERNMENT DOCUMENTS
HJ 1SPP T

US Doc ~~3720~~

US Doc 445

HARVARD UNIVERSITY
GRADUATE SCHOOL
OF BUSINESS
ADMINISTRATION
BAKER LIBRARY

GIFT OF

NEW LONDON PUBLIC LIBRARY

TRANSFERRED
TO
HARVARD COLLEGE
LIBRARY

WAR DEPARTMENT

Annual Reports, 1909

(IN NINE VOLUMES)

Volume V

Report of the

CHIEF OF ENGINEERS

(Without Appendices)

WASHINGTON
GOVERNMENT PRINTING OFFICE
1909

US Doc 445

NEW LONDON
PUBLIC LIBRARY
G

ARRANGEMENT OF THE ANNUAL REPORTS OF THE WAR DEPARTMENT FOR THE YEAR ENDED JUNE 30, 1909.

Volume I..............Secretary of War.
Chief of Staff.
The Adjutant-General.
Inspector-General.
Judge-Advocate-General.

Volume II.......**Armament, Transportation, and Supply:**
Quartermaster-General.
Commissary-General.
Surgeon-General.
Paymaster-General.
Chief of Engineers, Military Affairs.[a]
Chief of Ordnance.[b]
Chief Signal Officer.
Chief of Coast Artillery.
Board of Ordnance and Fortification.

Volume III......**Division and Department Commanders:**
1. Department of the East.
2. Department of the Gulf.
3. Department of the Lakes.
4. Department of the Missouri.
5. Department of Dakota.
6. Department of Texas.
7. Department of the Colorado.
8. Department of California.
9. Department of the Columbia.
10. Philippines Division.
11. Department of Luzon.
12. Department of the Visayas.
13. Department of Mindanao.
14. Army of Cuban Pacification.

Volume IV......**Military Schools and Military Parks:**
Military Academy—
  1. Superintendent.
Army Service Schools—
  1. Commandant.
  2. Assistant Commandant.
  3. Secretary.
  4. Librarian.
  5. Of the Line.
  6. Staff College.
  7. Signal.
Mounted Service School.
Coast Artillery School.
Engineer School.
Military Parks—
  1. Chickamauga and Chattanooga.
  2. Gettysburg.
  3. Shiloh.
  4. Vicksburg.

Volume V............Chief of Engineers.

Volume VI...........Chief of Ordnance.

Volume VII...........Insular Affairs, and Philippine Commission.

Volume VIII.........Acts of Philippine Legislature.

Volume IX............Governor of Porto Rico.

---

[a] Printed in Report of Chief of Engineers, Vol. V.
[b] Printed in Report of Chief of Ordnance, Vol. VI.

ANNUAL REPORT

OF THE

CHIEF OF ENGINEERS,

UNITED STATES ARMY.

1909.

WAR DEPARTMENT.

Document No. 351.

Office of the Chief of Engineers.

2

REPORT

OF

THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

War Department,
Office of the Chief of Engineers,
Washington, September 29, 1909.

Sir: I have the honor to present for your information the following report upon the duties and operations of the Engineer Department for the fiscal year ending June 30, 1909.

OFFICERS OF THE CORPS OF ENGINEERS.

The number of officers holding commissions in the Corps of Engineers at the end of the fiscal year was 183, a net increase during the year of 11.

Since July 1, 1908, the Corps of Engineers has lost 4 of its officers—Col. Thomas W. Symons, who was retired from active service on July 28, 1908, upon his own application, under the provisions of section 1243, Revised Statutes, after more than thirty-seven years' service; Col. Richard L. Hoxie, who was retired from active service on August 7, 1908, under the requirements of the act of Congress approved June 30, 1882, and placed upon the retired list of the army with rank of brigadier-general, under the provisions of the act of Congress approved April 23, 1904; Col. Milton B. Adams and Col. Ernest H. Ruffner, who were retired from active service April 11, 1909, and June 24, 1909, respectively, under the requirements of the act of Congress approved June 30, 1882. There were added to the Corps of Engineers during the fiscal year, by the assignment of graduates of the United States Military Academy, 15 second lieutenants, whose commissions date from June 11, 1909.

On the 30th of June, 1909, the distribution of officers of engineers according to their duties was as follows:

Chief of Engineers, in command of the Engineer Department, etc	1
Assistants to the Chief of Engineers	7
River and harbor work and The Board of Engineers	1
River and harbor work, The Board of Engineers, and the Light-House Board	1
River and harbor work, The Board of Engineers, and fortifications	1
River and harbor work	15
River and harbor work and fortification work	18
River and harbor work and light-house duty	8

River and harbor work, fortification work, and light-house duty	6
River and harbor work and chief engineer officers, military departments	6
River and harbor work, fortification work, and Washington Aqueduct	2
Engineer secretary to the Light-House Board	1
On duty on and under the Panama Canal Commission	13
At Engineer School, Washington Barracks, D. C., and with troops stationed there	22
On duty at the service schools, Fort Leavenworth, Kans	3
With the government of the District of Columbia	3
River and harbor work, fortification work, light-house duty, and command of engineer troops in the Hawaiian Islands	1
On duty with troops at Fort Leavenworth, Kans	14
Public buildings and grounds, District of Columbia	1
Fortification work and chief engineer officer, Philippines Division	1
Assistant chief engineer officer, in charge of military mapping, Philippine Islands	1
On duty at the Army War College	1
On the General Staff	1
On duty at the United States Military Academy	10
On leave of absence	1
Fortification work in the United States	2
On duty with troops in Hawaiian Islands	4
On duty with troops in and en route to the Philippine Islands	11
Road work in Alaska	1
Superintendent of the State, War, and Navy building	1
On duty with troops at Vancouver Barracks, Wash	4
In charge of the improvement of the Yellowstone National Park	1
Fortification work in the Philippine Islands	1
On duty with United States cavalry team, national match	1
On survey duty in the Yosemite National Park	1
Absent, sick	2
On graduation leave of absence	15
Total	183

The above table shows that out of a total of 183 officers, only 48, or approximately 26 per cent, were on duty wholly under the control of the Chief of Engineers; 23, or 12 per cent more, were performing some duty under the control of the Chief of Engineers, while at the same time performing other duties under various other branches of the Government; while 93, or 50 per cent of the entire corps, were on duty entirely detached from the control and supervision of the Chief of Engineers; in addition, 15 were on graduation leave from the United States Military Academy, 2 were absent sick, and 1 was on leave of absence granted by the military authorities.

With regard to the character of the duties performed, 44 officers were engaged on nonmilitary duty exclusively; 77 on military duty exclusively; while 36 were performing both military and nonmilitary duty. The diversified character of the duties assigned to the Corps of Engineers is well shown by this table.

As pointed out in my last annual report, the duties devolving upon the Corps of Engineers are increasing year by year. The corps is now charged with the construction and repair of fortifications; the superintendence and execution of works of river and harbor improvements; the construction and repair of light-houses in the United States, Alaska, and Hawaii; the water supply, municipal engineering, care of public buildings and grounds, and a share in the government of the capital city of the United States; the improvement of the Yellowstone National Park; the survey of the northern and northwestern lakes; the mining and débris commission of the State of California; the chairmanship and majority membership of the Panama Canal Commission and the execution of work under this commission; all of which involve the expenditure of many millions of dollars annually; and, in addition, various other duties, such as the command of three battalions of engineer troops, the supervision of military engineering, reconnaissance and survey work in the several military departments, road work in Alaska, a geodetic survey in the Philippine Islands, attendance at the War College, instruction in the service schools and at the Military Academy, membership in the General Staff, duty on various important boards, and extensive surveys connected with proposed river and harbor work and with the land defense of our seacoast fortifications.

There is every reason to believe that this increase in the demands upon the corps will continue. Interest in the improvement of the waterways of the country is increasing, and the demand for the inauguration of large projects is becoming continually more pressing. The intracoastal waterway survey, the extensive surveys of the Ohio River, the investigation for an improved channel in the Mississippi River, besides a large number of preliminary examinations and surveys ordered by the river and harbor act of March 3, 1909, throw additional burdens upon the corps, already charged with many and varied works of improvement, while the Panama Canal continues to claim the services of more than 7 per cent of its officers.

Along with the increasing demands of nonmilitary work has grown the demand for officers and men to perform the strictly military duties of the corps. Engineer officers and troops are now engaged in making extensive military surveys in the Departments of the East, the Columbia, and California, and in the Philippines and in Hawaii, and calls for similar services have come from other points. Fortification work is actively in progress in the Philippines and in Hawaii, as well as in this country. The General Staff, the command of the engineer troops, the War College, the service schools, and the Military Academy all continue to demand their quota of the corps.

The increasing demands of these various classes of duties, both military and nonmilitary, have been met by increasing the duties and responsibilities of individual officers, and the assignment of extra work to many officers already overburdened. In several cases, it has become necessary to combine, under one head, two engineer districts, each of which is of sufficient importance and complexity to require the undivided attention of one officer. In several cases, a single officer is in charge of important river and harbor work, of light-house construction, and of fortification work, diverse duties, each requiring its own special knowledge and forms of procedure. In addition, these officers are called upon to serve on various important boards, entailing, in many cases, not only executive work, but a large amount of individual research. Under these circumstances it is growing more and more difficult for the officers of the corps to devote to each of the various works in their charge the proper amount of detailed consideration and study. It has also become necessary to largely diminish the former practice of assigning young officers to duty in the various engineer districts as assistants to older officers, in order that they may, by observation and practice, become fitted to assume charge of important construction work in their turn. It has become necessary, in several cases, to assign to the responsible charge of an engineer district a young officer who has had no previous experience on such work. Similarly, engineer companies have been left for long periods under the command of young second lieutenants only a year or two out of the Military Academy, for want of captains who could be assigned to their command.

Since 1897 the authorized strength of the Corps of Engineers has been three times increased. Prior to that year the authorized strength was 109 officers of all grades, this having been the organization since the year 1866. In 1898, to meet the demands of the war with Spain, the authorized strength was increased to 127. By the act of February 2, 1901, the second increase was authorized, adding 33 officers to the authorized strength; but at the same time the number of engineer troops was increased from one battalion of 4 companies, to three battalions of 4 companies each, demanding the services of 30 additional officers with the new battalions. The new troops thus absorbed practically the entire authorized increase in the number of officers; and as the increase in officers was confined to the grades of captain and lieutenant—5 in the former, and 28 in the latter grade—whereas the troops required the assignment of 2 additional majors and 8 additional captains to command the new battalions and companies, the practical result of the increase was a diminution of 5 in the number of officers of experience available for construction work. This effect was emphasized by the fact that as the Corps of Engineers is, by law, recruited entirely from graduates of the United States Military Academy, it proved impossible to obtain, at once, the full number of officers to fill the newly created positions, so that the net result of the legislation was an immediate and considerable diminution in the number of officers of all grades below that of lieutenant-colonel available for assignment to construction work. By the act of April 23, 1904, the corps was increased to its present authorized strength of 188 officers. The same difficulty was at first experienced in filling the original vacancies created by this act, but this has now been largely overcome, and hereafter the corps may be kept at full strength.

Each of the increases mentioned above was immediately absorbed by the increased duties, which had been the reason for the increase, or which had accompanied it. There are now 183 officers holding commissions in the Corps of Engineers, as compared with 111 on June 30, 1897; but the number of officers now on duty under the exclusive control of the Chief of Engineers is but 48, as compared with 71 in 1897; while the number of officers now on duty beyond the control of the Chief of Engineers is 93, as compared with 27 in 1897. In addition, 23 officers are now performing some duties under the Chief of Engineers and some under other authority, as compared with 12 in 1897. The net result has been an actual and substantial decrease in the number of officers available for carrying on the river and harbor and other construction work of the corps, which has increased enormously in this period of 12 years. This effect is largely due to the increase in the strictly military duties of the corps. In 1897 18 officers were engaged solely on duties of this character and 47 upon such duty in addition to nonmilitary duties, while in 1909 77 officers were engaged on military duty exclusively, and 36 others were performing military duty in addition to other work.

Under these circumstances, I repeat the recommendation made in my last report that the authorized strength of the corps be increased by at least 60 officers, this increase being absolutely necessary to provide a proper organization of the corps for carrying on the work now devolving upon it. As stated in my last year's report, this increase should be effected in the grades above that of second lieutenant, the present authorized number of second lieutenants being sufficient for the performance of duties properly assignable to officers of that grade. A bill originating in the River and Harbor Committee of the House of Representatives was introduced at the last session of Congress, providing an increase of 60 officers, distributed among the grades in such a manner as to make the proportion of field officers in the Corps of Engineers approach more closely to that in the other permanent staff corps, adding to the corps 5 colonels, 6 lieutenant-colonels, 19 majors, 17 captains, and 13 first lieutenants.

This increase in the number of officers in the corps is regarded as absolutely necessary to meet the existing conditions in time of peace. In the event of war with a first-class power, the full number of officers recommended will be necessary for the proper discharge of the military duties of the Corps of Engineers, embracing military reconnaissance and mapping, laying out of camps, the planning and superintendence of defensive and offensive works by the troops, the construction and repair of military roads, railroads, and bridges, demolitions, siege works, and the construction and repair of seacoast fortifications. In time of peace this full number of officers will be profitably engaged in the direction and execution of public engineering works, thereby not only affording a well-trained and well-regulated organization for the conduct of these works, but, at the same time, perfecting themselves in the principles of engineering and the practice of administration under government methods and accounting, and thus preparing themselves for greater usefulness in war. If provision is made for the payment of engineer officers, while engaged on river and harbor work, from the appropriations for such works, the increase above recommended will be attended by no increase in the appropriations for the support of the army. The increase over the present authorized strength should be extended over a period of about five years, by providing that only about one-fifth of the original vacancies created shall be filled in each year, thus effecting a gradual expansion and avoiding the difficulties inherent in the immediate entry and assimilation of so large an amount of new material.

ENGINEER TROOPS.

The increase in officers referred to above is the number considered necessary for properly carrying on the work now devolving upon the Corps of Engineers, and takes no account of a possible increase in the number of engineer troops. In my last annual report, I pointed out the fact that any further increase in the engineer troops should be accompanied by a corresponding increase in officers, in order to avoid the necessity for withdrawing from construction work the necessary officers for duty with the additional battalions, which has heretofore so handicapped the civil work of the corps. It is understood that this subject is under consideration by the General Staff, and that this body will recommend, in due time, an appropriate organization of engineer troops, with suitable provision for both officers and men.

The necessity for an increase in the number of engineer troops was recognized during the calendar year 1907 by the issuance of General Orders, No. 199, War Department, September 25, 1907, putting the engineer troops on a war basis, and authorizing the recruiting of the companies to the full war strength of 164 men. For reasons explained later in this report, it has been found difficult to raise these companies to their full authorized strength.

NONCOMMISSIONED OFFICERS OF ENGINEERS.

In my last report I recommended the establishment of certain higher grades of noncommissioned officers in the Corps of Engineers, comparable to those in certain other branches of the service, stating my reasons for this recommendation. The experience of another year has only emphasized the necessity for some such measures as were then recommended, in order that the engineer troops may continue to attract and to hold the class of men necessary for the proper execution of the varied works which they are called upon to perform. The extensive military surveys in this country and in the island possessions, the proper handling of explosives, photography and map reproduction, drafting, the supervision and direction of working parties, both of troops and of civilian labor, the thorough practical knowledge of fieldworks, military bridges, ponton bridges, demolitions, military mining, and road construction, all of which fall within the duties of engineer troops, demand long and careful training, combined with technical skill in the mechanical trades, and presuppose a high grade of enlisted men. This grade of men is no longer attracted to the engineer troops. The work of this branch of the service is arduous, and pay and opportunities for advancement are no longer such as to attract the best men. Engineer troops are expected and required to perform all the usual post duties, to be well trained in infantry maneuvers and in rifle practice, to understand the handling of horses and mules, and in addition to be thoroughly trained in their own special technical duties. Men about to enlist are guided largely in their choice of a branch of the service by the relative opportunities of advancement offered in the several branches, as well as by the relation between the character of the work and the compensation received. If the engineers are to continue to attract the grade of men needed to properly perform the duties of this branch, they must offer opportunities of advancement at least equal to those of the other technical branches of the service, such as the Coast Artillery and the Signal Corps. Under present conditions, not only do the better and more intelligent class of men hesitate to enlist in the engineers, but the engineers are subject to a steady drain of their best men, through refusal to reenlist on discharge, through discharge by purchase, and through transfer to other branches of the service, where easier service is rewarded by almost equal pay. It is believed that if the efficiency of the engineer troops is to be kept up to the high standard demanded and expected of them these conditions must be remedied by increasing the opportunities of promotion for good men and by the creation of additional higher grades as a reward for special excellence. As the technical duties of engineer troops require the frequent detachment of small parties, or of individuals, for special duties, or for the supervision of working parties, the exact proportion between the number of privates, corporals, and sergeants, based upon the number of squads and sections in the company, is not applicable. Furthermore, the care of the ponton trains, tool wagons, mules, and horses of mounted sections requires wagoners, artificers, saddlers, blacksmiths, and farriers.

The number of cooks allowed to an engineer company should also be increased, as the number now authorized—two for a company of 164 men—is too small for the performance of their duties. This number is the same as is allowed to a company of 65 men in the cavalry and infantry, to a company of 109 men in the Coast Artillery Corps, and to the peace strength of 100 men in an engineer company. In the field artillery (light), three cooks are allowed to a battery of 133 men, and in the field artillery (horse), three cooks to a battery of 150 men, while in the provisional organization of a signal corps company, four cooks are allowed to 150 men. This latter number is regarded as necessary for an engineer company of 164 men, especially in view of the fact that detachments of considerable size are often separated from the company on special service requiring the services of a cook with each detachment, as well as at the headquarters of the company.

The designation of the present grade of "private, second class," should be changed to "private," as the description "second class" is distasteful to the men, and is unnecessary to distinguish this grade from that of "private, first class." This change would also emphasize more clearly the fact that appointment as private, first class, is a promotion in grade, and not merely an increase in pay.

I therefore recommend the following changes in the organization of the enlisted personnel of the Corps of Engineers:

That there be added to the noncommissioned staff of each battalion 1 battalion commissary-sergeant, 1 color-sergeant, and 1 train-sergeant, with the rank and pay of the present battalion sergeants-major, and 1 trumpeter-corporal with rank and pay of corporal of engineers.

That there be added to each company of engineers 10 sergeants, first class, with the rank and pay of sergeants, first class, in the Signal Corps, and electrician-sergeants, first class, in the Coast Artillery Corps; 2 mechanics, 2 wagoners, 2 farriers, 1 blacksmith and 1 saddler, with the rank and pay of corresponding grades in the Coast Artillery Corps and in the cavalry; and that the first sergeants and company quartermaster sergeants have the rank and pay of sergeants, first class.

That the number of sergeants in each engineer company be increased to 22, the number of corporals to 26, and the number of cooks to 4; that the number of privates, first class, be reduced to 36, and that the designation of the grade now designated as "private, second class," be changed to "private," and the number reduced to 54, thus leaving the total strength of the company at 164 men, as at present.

I repeat my recommendation of last year, that there be established in the Corps of Engineers a grade to be known as "Military overseer," or "Enlisted specialist," with the rank, pay, and emoluments now authorized by law for master electrician in the Coast Artillery Corps, and master signal electrician; that the authorized number of such military overseers be 100, and that they be assigned to duties and stations upon the recommendation of the Chief of Engineers; one to be habitually stationed at each seacoast fort, as foreman of engineer construction and working parties, in lieu of the civilians now employed for these purposes; and the remainder to be assigned to duty with the various engineer companies, for the performance of work requiring special skill. Appointment to this grade should be reserved for men especially expert in topography, drafting, photography, lithography and map reproduction, demolitions, road building, military mining or field engineering, or specially qualified as overseers on construction work, and should be regulated by the same rules and procedure as are now prescribed for appointment to the grades of master electrician in the Coast Artillery Corps and master signal electrician.

THE BOARD OF ENGINEERS.

The regulations for the government of the Corps of Engineers provide for a Board of Engineers, consisting of not less than three officers designated by the Chief of Engineers, with the sanction of the Secretary of War. This Board acts in an advisory capacity to the Chief of Engineers upon important questions of engineering. One of its principal duties is to plan or revise the projects for permanent fortifications of the United States.

During the fiscal year the Board has reported upon various subjects connected with fortification work.

A statement of the composition of this Board during the last fiscal year will be found in its report.

(See Appendix No. 1.)

FORTIFICATIONS.

The scheme of national defense upon which work was in progress between 1888 and 1906 was based primarily upon a report submitted January 16, 1886, by the Endicott Board. On January 31, 1905, the President organized a board, with the Secretary of War as president, to review the projects for the United States and for the insular possessions, to indicate the localities where defenses are most urgently needed, and to determine the character and general extent of the defenses, with their estimated cost. This Board is known as the National Coast Defense Board. The Board submitted its final report February 1, 1906.

Permanent seacoast defenses have been installed at the following localities in the United States:

1. Kennebec River, Maine.
2. Portland, Me.
3. Portsmouth, N. H.
4. Boston, Mass.
5. New Bedford, Mass.
6. Narragansett Bay, Rhode Island.
7. Eastern entrance to Long Island Sound.
8. New York, N. Y.
9. Delaware River.
10. Baltimore, Md.
11. Washington, D. C.
12. Hampton Roads, Virginia.
13. Cape Fear River, North Carolina.
14. Charleston, S. C.
15. Port Royal, S. C.
16. Savannah, Ga.
17. Key West, Fla.
18. Tampa Bay, Florida.
19. Pensacola, Fla.
20. Mobile, Ala.
21. New Orleans, La.
22. Galveston, Tex.
23. San Diego, Cal.
24. San Francisco, Cal.
25. Columbia River, Oregon and Washington.
26. Puget Sound, Washington.

In accordance with the report of the Board above mentioned additional defenses are to be constructed at some of these points and also at the entrance to Chesapeake Bay as soon as funds are provided by Congress.

Appropriations for construction of gun and mortar batteries have been made as follows:

Act of—	
August 18, 1890	$1,221,000.00
February 24, 1891	750,000.00
July 23, 1892	500,000.00
February 18, 1893	50,000.00
August 1, 1894	500,000.00
March 2, 1895	500,000.00
June 6, 1896	2,400,000.00
March 3, 1897	3,841,333.00
Allotments from the appropriation for "National defense," act of March 9, 1898	3,817,676.02
Act of—	
May 7, 1898	$3,000,000.00
July 7, 1898	2,562,000.00
March 3, 1899	1,000,000.00
May 25, 1900	2,000,000.00
March 1, 1901	1,615,000.00
June 6, 1902	2,000,000.00
March 3, 1903	2,236,425.00
April 21, 1904	700,000.00
May 27, 1908	300,000.00
March 3, 1909	5,064.00
Total	28,998,498.02

The following table shows the present status of permanent work completed or in progress with funds already provided:

Calibers.	Total number carried by scheme of National Coast Defense Board.	Provided for by appropriations made by Congress.
12-inch mortars	464	376
16-inch rifle	1	
14-inch rifles	19	
12-inch rifles	138	107
10-inch rifles	139	133
8-inch rifles	72	70
6-inch rapid-fire guns	191	175
5-inch rapid-fire guns	53	53
4.7-inch and 4-inch rapid-fire guns	38	38
3-inch rapid-fire guns	284	254

The defensive requirements of our seacoast may be subject to change to meet new requirements due to changes in commercial and naval vessels, but for present conditions the National Coast Defense Board scheme is sufficient. It carried an estimate amounting to $10,836,400 for emplacement construction (not including electrical light or power or land for sites). Appropriations to date, since the submission of the report of the Board, aggregate $305,064, leaving $10,531,336 to be appropriated for these purposes.

Congress at its last session provided a special appropriation of $5,064 to cover the cost of Engineer Department changes in an emplacement to enable the Ordnance Department to substitute for an existing carriage of old and experimental type, one that is uniform with the other two carriages emplaced in the same three-gun battery. This work is well under way and its early completion is expected.

At the close of the fiscal year the status of emplacements for which funds have been provided by Congress is as follows:

	12-inch mortars.	12-inch.	10-inch.	8-inch.	Rapid-fire.
Guns mounted	376	[a] 105	[b] 126	[c] 97	[d] 434
Ready for armament			7	2	[e] 83
Under construction		2			4
Total	376	107	133	99	521

[a] Including 2 guns on hydraulic lifts, now dismounted.

[b] Including original experimental 10-inch carriage, now dismounted.

[c] Including 26 which have been dismounted since the war with Spain, 3 which are now temporarily mounted, and 3 which have been dismounted for emplacement elsewhere.

[d] One temporarily.

[e] Excluding 70 6-pounders not requiring permanent emplacements.

At the close of the previous fiscal year there were reported mounted:

12-inch mortars.	12-inch.	10-inch.	8-inch.	Rapid-fire.
376	105	126	94	406

A comparison of the last two tables shows an increase during the year in guns actually available for service of 3 8-inch guns and 28 rapid-fire guns.

The following table shows that the Engineer and Ordnance departments have worked in harmony, the number of gun carriages and emplacements being the same except where extra carriages are needed for purposes other than seacoast defense:

Type of gun or carriage.	Total carriages provided.	Total emplacements provided.
12-inch mortar carriages, model 1896	[a] 298	296
12-inch mortar carriages, model 1891	[b] 85	80
12-inch disappearing carriages, L. F., model 1901	13	13
12-inch disappearing carriages, L. F., model 1897	35	35
12-inch disappearing carriages, L. F., model 1896	27	27
12-inch gun-lift carriages, altered to nondisappearing	2	2
12-inch gun-lift carriages, model 1891	[c] 2	[d] 2
12-inch nondisappearing carriages, model 1892	28	28
10-inch disappearing carriages, A. R. F., model 1896	3	3
10-inch disappearing carriages, L. F., model 1901	12	12
10-inch disappearing carriages, L. F., model 1896	74	74
10-inch disappearing carriages, L. F., model 1894	[e] 35	35
10-inch nondisappearing carriages, model 1893	[f] 10	9
8-inch disappearing carriages, L. F., model 1896	38	[g] 41
8-inch disappearing carriages, L. F., model 1894	[h] 26	[g] 25
8-inch nondisappearing carriages, model 1892	[j] 9	[k] 9
15-inch smoothbore carriages altered for 8-inch rifles	21	[l] 21
6-inch disappearing carriages, model 1905	4	4
6-inch disappearing carriages, model 1903	90	90
6-inch disappearing carriages, model 1898	29	29
6-inch rapid-fire (Vickers Son & Maxim), pedestal mounts	8	8
6-inch rapid-fire, pedestal mounts, model 1900	[i] 45	44
5-inch balanced-pillar mounts, model 1896	32	32
5-inch pedestal mounts, model 1903	21	22
4.7-inch rapid-fire (Armstrong pattern), pedestal mounts	[i] 34	33
4.7-inch rapid-fire (Schneider pattern), pedestal mounts	1	[m] 1
4-inch rapid-fire (Driggs-Schroeder), pedestal mounts	4	4
3-inch balanced-pillar mounts	[n] 118	[o] 114
3-inch casemate mounts	2	2
3-inch pedestal mounts, model 1902	60	60
3-inch pedestal mounts, model 1903	[i] 79	78
2.24-inch rapid-fire field carriages and rampart mounts	70	(p)

[a] Two at Sandy Hook Proving Ground.

[b] One in use at West Point; 4 in storage.

[c] One has been altered for use at Proving Ground.

[d] Armament dismounted.

[e] One carriage is the original experimental one for this caliber of gun, and has been put out of service at the instance of the Coast Artillery Corps.

[f] One at Sandy Hook Proving Ground.

[g] One emplacement originally built for experimental carriage altered to receive a carriage of model 1896.

[h] One carriage is the original experimental one for this caliber of gun, and has been put out of service.

[i] One at Sandy Hook Proving Ground.

[j] One at West Point and 1 at Sandy Hook Proving Ground.

[k] Five temporary; armament removed from 3.

[l] Temporary; armament removed from 20.

[m] Temporary; armament removed.

[n] Two at Sandy Hook Proving Ground; 4 at Watertown Arsenal.

[o] Two without armament.

[p] Movable mounts.

Modernizing older emplacements.—The fortification appropriation act approved March 3, 1909, provided the sum of $100,000 for modernizing older emplacements. This sum is being applied in continuing the installation of mechanical devices to facilitate the supply of ammunition from the magazines to the loading-platform level, such mechanical devices being considered absolutely necessary by the artillery to permit the utilization of the full possibilities of the rapid rate of fire possessed by modern ordnance.

Much remains to be done to place the older batteries in satisfactory condition for efficient operation; powder hoists in gun emplacements, widening loading platforms, electric wiring of emplacements to place fire-control instruments on the gun carriages, and platform lighting are the main items. Detailed estimates have been prepared for the work of the above classes still required in the United States; the aggregate of the estimate is $966,100. An estimate of $500,000 for this work was prepared by the Chief of Engineers, but by direction of the Secretary of War this item was omitted from the estimates finally submitted by the Chief of Engineers.

Fire control at fortifications.—The fortification appropriation act approved May 27, 1908, provided the sum of $270,256 for this purpose, to be distributed in the discretion of the Secretary of War among the Engineer and Ordnance departments and the Signal Corps. Of this amount the sum of $129,456 was assigned to the Engineer Department. Engineer work is now in progress with these funds, and the close of the present working season will show substantial progress on the work intended to be accomplished therewith.

The fortification appropriation act approved March 3, 1909, provided the sum of $247,055 for this purpose, of which amount the sum of $20,000 has been assigned to the Engineer Department to enable important work to be completed pending the distribution of the entire amount of the appropriation. Plans and estimates are in course of preparation for Engineer Department work desired to be accomplished under this appropriation, and it is expected that the remainder of the appropriation will be distributed among the construction and supply departments concerned and work therewith be begun before the end of the working season.

An estimate of $1,275,858 to cover the work of the Engineer and Ordnance departments and the Signal Corps under this head for the next fiscal year was prepared by the Chief of Coast Artillery; it is understood that in the estimates finally submitted this item has been reduced to $200,000.

Electrical installations.—The National Coast Defense Board estimated that $5,216,031 would be required to furnish the necessary electrical equipment for the defenses of the United States in addition to the current required for searchlights.

The fortification act of May 27, 1908, provided the sum of $348,888 for this purpose, and the act of March 3, 1909, the sum of $100,000. With these funds electric plants are being procured and installed at posts where the requirements are most urgent.

For continuing the installation of this equipment at the defenses where the Chief of Coast Artillery states they are most needed an estimate of $534,718 was prepared by the Chief of Engineers, but this item was omitted from the estimates finally submitted.

Sites for fortifications.—During the fiscal year ending June 30, 1907, a site was acquired at Boston, Mass., a part of the purchase money being withheld, in accordance with the terms of the sale, until a wall separating the tract acquired from adjacent ground has been built by the city of Boston. During the past year the construction of the wall was completed and the remainder of the purchase money paid.

The question of the defense of San Pedro, Cal., was considered by the General Staff and a report submitted thereon and transmitted to Congress by the President on January 14, 1909. In submitting the report to the President the Secretary of War recommended that the sum of $400,000 be appropriated during the current session of Congress for the acquisition of the necessary land. For the acquisition of the land the sum of $250,000 was appropriated in the act of March 3, 1909. A careful investigation has been made of the land which must be acquired for the defenses projected and the garrison therefor and the amount which will be required for its acquisition. As a result of this investigation it is found that more than the $400,000 originally estimated will be required for this purpose. Under the provisions of existing law (33 Stats., 497), the entire tract required for the accommodation of the garrison and defensive works must be procured at one time. The $250,000 already appropriated is therefore held pending any further action in the matter which may be taken by Congress.

Searchlights.—After much experimental work and the practical test of use under regular service conditions, a satisfactory type of searchlight has been developed and forty have been contracted for under appropriations carried in the fortification appropriation act approved May 27, 1908, and their construction is well advanced. The deliveries of the generating sets contracted for under the appropriation in the act approved March 2, 1907, have continued and are nearly completed; they have proved satisfactory.

The fortification appropriation act approved March 3, 1909, carried an appropriation of $210,000 for the purchase of additional lights and their installation, and contracts for the apparatus will be awarded in the near future.

To carry on the work of installation, in accordance with the recommendations of the Chief of Coast Artillery, the Chief of Engineers prepared an estimate for the next fiscal year amounting to $897,000. This item was, however, by direction of the Secretary of War, reduced to $50,000 in the estimates finally submitted by the Chief of Engineers.

Preservation and repair of fortifications.—The modern works of defense now constructed represent an expenditure of approximately $28,000,000 for engineering work alone. For the preservation and repair of these works during the present fiscal year there was appropriated the sum of $225,000, less than 1 per cent of the cost of construction. These extensive works contain much costly machinery and ordnance material and must be kept properly painted and repaired to be effective when needed. The $225,000 appropriation of the act of May 27, 1908, was not sufficient to keep the essential features of the fortifications in satisfactory condition for an entire year, and a large proportion of the appropriation of a like amount carried in the fortification appropriation act approved March 3, 1909, has already been devoted to urgently necessary work, and practically the entire amount of the appropriation has been similarly pledged. Much desirable and necessary work is now awaiting future appropriations.

An estimate of $300,000 for preservation and repair is submitted, and it is strongly recommended (in the interest of economy and efficient service) that this amount be appropriated.

Repair and protection of defenses of Charleston, Pensacola, Mobile, and New Orleans.—For repairs and sea walls at these localities, rendered necessary by storms, the following estimates were submitted to Congress in 1906:

Charleston, S. C., for the construction of the sea wall necessary for the protection of Fort Moultrie	$225,600
Pensacola, Fla., for building sea walls for the protection of the sites of the fortifications and of the necessary post buildings at Forts Pickens and McRee	907,100
Pensacola, Fla., for repair and restoration of batteries and other structures appurtenant to the defenses of Pensacola, and for retaining walls to protect the batteries from floods	109,355
Mobile, Ala., for repair and restoration of batteries and other structures appurtenant to the defenses of Mobile, and for rebuilding sea walls and groins for protection of the sites of the fortifications of the garrison posts	1,089,500
New Orleans, La., for rebuilding and strengthening the levees for protection of the site of the defenses and the garrison post at Fort St. Philip	139,800

At the last three regular sessions of Congress appropriations were made covering the estimates for Charleston, Mobile, and Pensacola and providing $100,000 for the levees at Fort St. Philip, but authority to initiate the proposed protective levees for the last named in their entirety was not given. A portion of this reservation is therefore protected and the balance abandoned to overflow until further funds are available. Floods are higher than formerly, due to the building of levees below the forts.

To complete the protection of the Fort St. Philip reservation, an estimate of $40,000 was prepared by the Chief of Engineers, but, by direction of the Secretary of War, was omitted from the estimates to be submitted to Congress.

At Charleston, Pensacola, and Mobile the work is under way and progressing satisfactorily, and it is believed will be satisfactorily completed within the estimates.

Supplies for seacoast defenses.—Owing to the large number of electric installations supplying power and light in seacoast batteries, funds have been appropriated annually for "tools and electrical and engine supplies for use of the troops for maintaining and operating light and power plants in gun and mortar batteries." This appropriation is designed to enable the Engineer Department to comply with the regulations of the War Department for the supply and service of the batteries. Requisitions are made upon the Chief of Engineers, through the district engineer officers, and authorized articles are purchased and issued by district engineer officers with as little delay as possible. This system has proved eminently satisfactory to the garrisons.

The amount appropriated for this purpose in the act approved March 3, 1909, was $40,000.

As the earlier electric plants become worn with use, and as additional plants are installed from time to time, the demands upon the funds for the purchase of these supplies increase, and while great economy was exercised during the past year in the use of the $40,000 appropriated by the act of May 27, 1908, for general purchases, considerable difficulty was experienced in providing sufficient funds to all districts for the purchase of absolutely necessary supplies, and even greater difficulty is anticipated in procuring the supplies essential for the service during the current fiscal year.

The sum of $45,000 is estimated as necessary for the procurement of the regular electrical supplies for the next fiscal year, especially in view of the numerous installations being provided for battery lighting and power and for searchlight service.

Reserve lights.—A satisfactory form of reserve electric lantern has been produced as the result of exhaustive tests. To supply these lanterns in sufficient quantities to all batteries now in service an estimate of $19,500 was submitted last year. An appropriation of $10,000 for the purpose was contained in the appropriation act of March 3, 1909, and a contract covering that sum has been entered upon.

An estimate of $9,500, the unappropriated balance of the original estimate, was prepared by the Chief of Engineers, but, under instructions from the Secretary of War, this item has been omitted from the estimates finally submitted by the Chief of Engineers.

Sea walls and embankments.—The sum of $50,000 was appropriated for this purpose by the fortification appropriation act approved March 3, 1909. This amount is being applied to such work only as becomes urgently necessary for the protection of the defensive works.

Based upon detailed estimates prepared by district engineer officers, an estimate of $164,775 was prepared by the Chief of Engineers for the construction of sea walls and embankments at a number of localities on the Atlantic, Gulf, and Pacific coasts, where needed to protect the defenses. Under instructions from the Secretary of War, however, this item has been omitted from the estimates finally submitted by the Chief of Engineers.

Sea walls, defenses of Galveston, Tex.—The defensive works at Galveston were unavoidably in most exposed positions, and the level of the lands surrounding the batteries was greatly lowered by the storm of September 8, 1900. Work of reconstruction and repair of the Galveston defenses is now completed under the appropriation contained in the fortification act approved March 1, 1901. With the funds so provided, and in accordance with the plans before Congress when that appropriation was made, each individual battery has been made secure against any similar storms which are likely to occur in the future.

For building a sea wall and filling up the reservation at Fort Crockett to a height above storm tides the sums of $591,046.25 and $158,953.75 were appropriated in the sundry civil appropriation acts of April 28, 1904, and June 30, 1906, aggregating $750,000. Under these appropriations the work at Fort Crockett is now practically completed.

For similar work at Fort Travis the sum of $440,000 was provided in the fortification appropriation act approved March 3, 1909. The plans for this work have been completed, and actual operations will soon be begun.

Similar protection is required at Fort San Jacinto if this fort is to be garrisoned. There are certain claims to portions of this reservation adverse to the title of the United States. Until all clouds upon the title of the United States are removed no money should be expended on this reservation.

Preservation and repair of torpedo structures.—A large number of new torpedo-defense structures have been completed, and a number, in addition, are approaching completion. The appropriations made to date for building torpedo structures aggregate $2,403,000.

Situated as they are at exposed locations on the Atlantic, Gulf, and Pacific coasts, the requirements for the maintenance of these structures are considerable. The appropriation act of March 3, 1909, contained an item of $20,000 for this purpose. This sum is being applied to such minor repairs as are found from time to time to be most urgently necessary, but in view of the very large number of these structures and the necessity of frequent repainting and minor repairs to prevent marked deterioration in the buildings, this sum has sufficed for only such work as was most urgently necessary. The Chief of Engineers prepared an estimate of $50,000 for this purpose, but, by direction of the Secretary of War, this item was reduced to $20,000 in the estimates finally submitted by the Chief of Engineers.

Submarine mines.—While the operation of torpedo defenses is the duty of the Coast Artillery Corps, the building of structures required in connection therewith is under the charge of the Engineer Department.

To complete the engineer structures for the torpedo defenses recommended by the National Coast Defense Board, except at the entrance to Chesapeake Bay and at Galveston, Tex. (where, owing to the present status of the defenses and garrison posts, it is not considered advisable to build the torpedo structures immediately), an estimate of $189,964 was prepared by the Chief of Engineers in accordance with the request of the Chief of Coast Artillery, but, by direction of the Secretary of War, this item was omitted from the estimates as finally submitted by the Chief of Engineers.

The sum of $100,000 provided in the fortification act of March 3, 1909, is being applied in accordance with the artillery scheme.

Batteries in insular possessions.—The first appropriation for this purpose was contained in the fortification act approved April 21, 1904, and additional appropriations have been made in each of the five succeeding years, the aggregate amount appropriated to date being $5,051,200 (including $250,000 the expenditure of which has been assigned to the Chief of Ordnance). With these appropriations batteries have been constructed at Guantanamo Bay, Cuba, and construction work is now in progress at Honolulu and Pearl Harbor, Hawaii, and Manila and Subic Bay, Philippine Islands.

The defense of the important harbors of the insular possessions has been specially considered by the National Coast Defense Board, and any funds appropriated for batteries will be applied in accordance with the general projects of that board.

An estimate of $112,200 for additional batteries in the Hawaiian Islands, called for by the report of the National Coast Defense Board, was prepared by the Chief of Engineers, but, by direction of the Secretary of War, was omitted from the estimates finally submitted by the Chief of Engineers. For the Philippine Islands an estimate of $1,319,000 was prepared, of which amount $450,000 was included to cover the Engineer Department portion of an authorization of $600,000 contained in the act approved March 3, 1909, which will be needed to carry on work already under way under the appropriation carried in said act.

Electrical installations, insular possessions.—The National Coast Defense Board estimated that $788,713 would be required to furnish the necessary electrical equipment for the defenses of the insular possessions, in addition to the current required for searchlights.

Toward the installation of this equipment the sum of $238,292 has thus far been provided by Congress, $34,469 for the Hawaiian Islands and $203,823 for the Philippine Islands, of which $14,469 for the Hawaiian Islands and $88,823 for the Philippine Islands were carried in the act approved March 3, 1909. Work under these appropriations is now in progress. For the continuation of this work in the Philippine Islands in accordance with the plans of the National Coast Defense Board, an estimate of $127,346 is submitted.

Fire control in insular possessions.—The fortification act of March 3, 1909, provided $250,000 for this purpose, which sum was available for the work of the Engineer and Ordnance departments and the Signal Corps. Of this appropriation the sum of $207,000 is being applied to the work of the Engineer Department.

An estimate for the continuation of this work was prepared by the Chief of Coast Artillery, amounting to $250,000; in the estimates finally submitted this item was reduced to $200,000.

Searchlights, insular possessions.—For this purpose the sum of $227,500 was appropriated in the act of May 27, 1908, $47,500 for the Hawaiian Islands and $180,000 for the Philippine Islands, and the sum of $66,000 for the Hawaiian Islands was carried in the act approved March 3, 1909. These funds are being applied to the purpose for which appropriated. To complete the searchlight projects for the batteries thus far authorized in the Hawaiian Islands the Chief of Engineers prepared an estimate of $40,100, but, by direction of the Secretary of War, this item was omitted from the estimates finally submitted by the Chief of Engineers. For necessary searchlights for use with batteries already authorized in the Philippine Islands, an estimate of $139,200 is submitted.

Submarine mines, insular possessions.—The sum of $129,000 was appropriated in the fortification act of May 27, 1908, for the construction of torpedo structures for the defense of the Hawaiian Islands. Work is now being prosecuted with these funds.

Procurement of sites, insular possessions.—For the procurement of land or rights pertaining thereto in the Philippine Islands the sum of $5,000 was provided by the fortification act of May 27, 1908, and the additional sum of $12,000 by the act of March 3, 1909. Condemnation proceedings were instituted for the acquisition of the land; a decree has been rendered by the court, and final proceedings, including payment of the awards, are now in progress. It is expected that the title to all the tracts will be in the United States before the close of the current calendar year.

Preservation and repair of fortifications, insular possessions.—A number of the batteries authorized by Congress for the insular possessions have been completed and are being operated by the troops. Minor repairs, painting, etc., are from time to time necessary and have heretofore been met from balances of funds appropriated for construction purposes. The approaching completion of work at certain localities and the exhaustion of construction funds render provision for such work necessary in the future. The Chief of Engineers prepared estimates of $900, $1,500, and $14,000 for this purpose for the defensive works at Guantanamo Bay, Cuba, in the Hawaiian Islands, and in the Philippine Islands, respectively, but, by direction of the Secretary of War, in the final preparation of the estimates by the Chief of Engineers the items for Guantanamo Bay and for the Hawaiian Islands were omitted.

Preservation and repair of torpedo-defense structures in the insular possessions.—In order to provide for the maintenance in proper condition of the numerous structures already erected in connection with torpedo defense in the Philippine Islands, an estimate of $1,000 is submitted. An estimate of $500 for a similar purpose in the Hawaiian Islands was prepared by the Chief of Engineers, but, by direction of the Secretary of War, this estimate has been omitted.

Supplies for seacoast defenses, insular possessions.—Under appropriations heretofore made by Congress a number of electric plants have been installed in the defensive works in the Philippine Islands, and in order that the necessary supplies and materials may be furnished for their operation and maintenance, as for similar plants in this country, an estimate of $5,000 is submitted. For the same purpose in connection with plants installed and to be installed in the Hawaiian Islands, the Chief of Engineers prepared an estimate of $1,000, but, by direction of the Secretary of War, it was omitted in the preparation of the final estimates by the Chief of Engineers.

The following money statements show the condition on June 30, 1909, of all general appropriations under which operations were in progress at the close of the fiscal year:

"GUN AND MORTAR BATTERIES."

For battery construction.

July 1, 1908, balance unallotted	$313,226.34
March 3, 1909, appropriated	5,064.00
	318,290.34
June 30, 1909, net allotments during fiscal year	309,371.18
July 1, 1909, balance unallotted	8,919.16
July 1, 1909, amount pledged	8,919.16

For modernizing older emplacements.

July 1, 1908, balance unallotted	$167,296.36
March 3, 1909, appropriated	100,000.00
	267,296.36
June 30, 1909, net allotments during the fiscal year	194,966.36
July 1, 1909, balance unallotted	72,330.00
July 1, 1909, amount pledged	72,330.00

"FIRE CONTROL AT FORTIFICATIONS."

July 1, 1908, balance unallotted	$42,699.04
September 17, 1908, assigned to Chief of Engineers from the act of May 27, 1908	129,456.00
June 9, 1909, assigned to Chief of Engineers from the act of March 3, 1909 (partial assignment)	20,000.00
	192,155.04
June 30, 1909, net allotments during the fiscal year	192,129.08
July 1, 1909, balance unallotted	25.96
July 1, 1909, amount pledged	25.96

"ELECTRICAL INSTALLATIONS AT SEACOAST FORTIFICATIONS."

July 1, 1908, balance unallotted	$348,387.00
March 3, 1909, appropriated	100,000.00
	448,387.00
June 30, 1909, net allotments during the fiscal year	409,873.11
July 1, 1909, balance unallotted	38,513.89
July 1, 1909, amount pledged	38,513.89

"SEARCHLIGHTS FOR HARBOR DEFENSES."

July 1, 1908, balance unallotted	$246,901.00
March 3, 1909, appropriated	210,000.00
	456,901.00
June 30, 1909, net allotments during fiscal year	194,915.84
July 1, 1909, balance unallotted	261,985.16
July 1, 1909, amount held for installing lights and for purchase of new ones	261,985.16

"SITES FOR FORTIFICATIONS AND SEACOAST DEFENSES."

July 1, 1908, balance unallotted	$169,604.67
March 3, 1909, appropriated	250,000.00
	419,604.67
June 30, 1909, net allotments during the fiscal year	45,353.57
July 1, 1909, balance unallotted	374,251.10
July 1, 1909, amount pledged	315,000.00
July 1, 1909, balance available	59,251.10

"PRESERVATION AND REPAIR OF FORTIFICATIONS."

July 1, 1908, balance unallotted	$216,639.00
March 3, 1909, appropriated	225,000.00
	441,639.00
June 30, 1909, net allotments during the fiscal year	439,542.21
July 1, 1909, balance unallotted	2,096.79
July 1, 1909, amount pledged	2,096.79

"PLANS FOR FORTIFICATIONS."

March 3, 1909, appropriated	$5,000.00
June 30, 1909, net allotments during the fiscal year	5,000.00

"SUPPLIES FOR SEACOAST DEFENSES."

July 1, 1908, balance unallotted	$44,510.04
March 3, 1909, appropriated	40,000.00
	84,510.04
June 30, 1909, net allotments during the fiscal year	84,272.34
July 1, 1909, balance unallotted and available	237.70

For reserve lights.

March 3, 1909, appropriated	$10,000.00
June 30, 1909, net allotments during the fiscal year	10,000.00

"SEA WALLS AND EMBANKMENTS."

July 1, 1908, balance unallotted	$17,044.89
March 3, 1909, appropriated	50,000.00
	67,044.89
June 30, 1909, net allotments during the fiscal year	53,605.00
July 1, 1909, balance available for emergencies during fiscal year	13,439.89

"PRESERVATION AND REPAIR OF TORPEDO STRUCTURES."

July 1, 1908, balance unallotted	$2,921.20
March 3, 1909, appropriated	20,000.00
	22,921.20
June 30, 1909, net allotments during the fiscal year	21,031.05
July 1, 1909, balance unallotted and available	1,890.15

"CASEMATES, GALLERIES, ETC., FOR SUBMARINE MINES."

July 1, 1908, balance unallotted	$74,124.14
March 3, 1909, appropriated	100,000.00
	174,124.14
June 30, 1909, net allotments during the fiscal year	147,486.20
July 1, 1909, balance unallotted	26,637.94
July 1, 1909, amount pledged	26,637.94

"FORTIFICATIONS IN INSULAR POSSESSIONS."

For construction of seacoast batteries.

July 1, 1908, balance unallotted	$1,390,391.40
March 3, 1909, appropriated (for Hawaiian Islands)	337,200.00
March 22, 1909, assigned to Engineer Department by the Secretary of War from act approved March 3, 1909 (for Philippine Islands)	750,000.00
	2,477,591.40
June 30, 1909, net allotments during the fiscal year	1,647,277.68
July 1, 1909, balance unallotted	830,313.72
July 1, 1909, amount pledged	830,313.72

For electrical installations.

July 1, 1908, balance unallotted	$127,574.00
March 3, 1909, appropriated	103,292.00
	230,866.00
June 30, 1909, net allotments during the fiscal year	180,221.28
July 1, 1909, balance unallotted and available	50,644.72

For searchlights.

July 1, 1908, balance unallotted	$227,290.00
March 3, 1909, appropriated	66,000.00
	293,290.00
June 30, 1909, net allotments during the fiscal year	12,235.69
July 1, 1909, balance unallotted	281,054.31
July 1, 1909, amount pledged	281,054.31

For casemates, galleries, etc., for submarine mines.

July 1, 1908, balance unallotted	$128,767.84
June 30, 1909, refundments during the fiscal year	3,642.81
July 1, 1909, balance unallotted	132,410.65
July 1, 1909, amount pledged	128,767.84
July 1, 1909, balance available	3,642.81

For sites, Hawaiian Islands.

July 1, 1908, balance unallotted	$114,428.01
June 30, 1909, net allotments during the fiscal year	114,424.27
July 1, 1909, balance unallotted	3.74
July 1, 1909, amount pledged	3.74

For sites, Philippine Islands.

July 1, 1908, balance unallotted	$5,000.00
March 3, 1909, appropriated	12,000.00
	17,000.00
June 30, 1909, net allotments during the fiscal year	14,000.00
July 1, 1909, unallotted balance	3,000.00
July 1, 1909, amount pledged	50.00
July 1, 1909, balance available	2,950.00

"FIRE CONTROL IN INSULAR POSSESSIONS."

July 2, 1908, assigned from act of May 27, 1908	$75,000.00
March 31, 1909, assigned from act of March 3, 1909	207,000.00
	282,000.00
June 30, 1909, net allotments during the fiscal year	281,500.00
July 1, 1909, balance unallotted	500.00
July 1, 1909, amount pledged	500.00

Estimates of appropriations required for 1910–11 for fortifications.

	As originally prepared by Chief of Engineers.		As finally submitted.	
Gun and mortar batteries, for modernizing older emplacements		$500,000		0
Electrical installations at seacoast fortifications		534,718		0
Searchlights for harbor defenses		897,000		$50,000
Preservation and repair of fortifications		300,000		300,000
Repair and protection of defenses of New Orleans, La		40,000		0
Plans for fortifications		5,000		5,000
Supplies for seacoast defenses	$45,000		$45,000	
For reserve lights	9,500		0	
		54,500		45,000
Sea walls and embankments		164,775		0
Preservation and repair of torpedo structures		50,000		20,000
Casemates, galleries, etc., for submarine mines		189,964		0
Fortifications in insular possessions:				
For seacoast batteries—				
Hawaiian Islands	112,200		0	
Philippine Islands	1,319,000		1,319,000	
For electrical installations, Philippine Islands	127,346		127,346	
For searchlights—				
Hawaiian Islands	40,100		0	
Philippine Islands	139,200		139,200	
For preservation and repair of fortifications at the following localities—				
Guantanamo Bay, Cuba	900		0	
Hawaiian Islands	1,500		0	
Philippine Islands	14,000		14,000	
For preservation and repair of torpedo structures at the following localities—				
Hawaiian Islands	500		0	
Philippine Islands	1,000		1,000	
For supplies for seacoast defenses at the following localities—				
In the Hawaiian Islands	1,000		0	
In the Philippine Islands	5,000		5,000	
		1,761,746		1,605,546
Total		4,497,703		2,025,546

ENGINEER DEPOTS AT WASHINGTON BARRACKS, DISTRICT OF COLUMBIA, FORT LEAVENWORTH, KANSAS, AND VANCOUVER BARRACKS, WASHINGTON.

Officers in charge: Depot at Washington Barracks, Lieut. Col. William C. Langfitt, Corps of Engineers; Depot at Fort Leavenworth, Maj. Thomas H. Rees, Corps of Engineers, until August 10, 1908, and Maj. Clement A. F. Flagler, Corps of Engineers, since that date; Vancouver Barracks, Capt. Elliott J. Dent, Corps of Engineers.

ENGINEER DEPOT, WASHINGTON BARRACKS.

This depot is the repository for part of the military bridge equipage of the army; for miscellaneous military engineering tools, supplies, and materials of all kinds, and for astronomical, surveying, drafting, and reconnaissance instruments and supplies used by the army and by officers of the Corps of Engineers on public works, both military and civil. It purchases and issues military engineering tools and supplies and serves particularly as an exchange for engineer instruments of all kinds, receiving them from the army or public works, caring for them while in store, causing to be made the necessary repairs, reissuing them when required, and, so far as limited appropriations will permit, making purchases of such items as can not be supplied from store.

The general work of the depot consisted of care of the property on hand, purchase of new articles, and shipment to troops of supplies as needed, and constructing ponton equipage. The work this year is believed to have exceeded that of any previous one as shown by the total weight of supplies shipped from the depot.

The old building used for various shops of the depot, being on part of the reservation assigned to the War College, was demolished by the Quartermaster's Department, and as the shops are the most essential part of the depot a new building should be provided for immediately.

There is no available place on the post for the storage of the various wagons pertaining to the bridge trains, and the space available for the storage of miscellaneous lumber and bridge material is far too small. These imperative needs of the depot should be attended to at an early date. Roughly estimated, the construction of such a shed for the protection of ponton wagons and other heavy bulky ponton material, and for protecting all sorts of lumber used at the depot for various purposes would cost about $15,000.

ENGINEER DEPOT, FORT LEAVENWORTH.

This depot is the repository for part of the military equipage of the army. The general work of the office and storehouse consisted of care of property on hand, the purchase of supplies, occasional shipments to troops, and repair of instruments issued to the battalion of engineers there stationed, and the keeping of the depot accounts and records.

The shop was in operation from July 1 to 25, and from October 1 to June 30. Most of the work consisted of repairs to the old ponton chess and tool wagons at the depot, and to other equipment damaged by wear in the service. A number of trestles, paddles, drawing tables and stools, skiffs, sap tools, pickets, and other minor articles of equipment were also made. With the exception of the ponton wagons, 13 chess wagons, 2 tool wagons, 1 reserve ponton, the advance guard pontons, and 500 13-foot chess, all property carried on the depot return is in good condition and fit for field service.

ENGINEER DEPOT, VANCOUVER BARRACKS.

During the year a ponton train consisting of the principal items of one division advance and one division reserve equipage was transferred from the engineer depot at Fort Mason, Cal., to this depot. Considerable work in overhauling the equipage was done. New balk and chess were made from material on hand and all old balk were tested to a fiber stress of approximately 4,000 pounds per square inch.

The details of the operations of the depots will be found in the reports of the officers in charge.

ENGINEER DEPOTS, 1909.

Incidentals.

Amount appropriated in the army appropriation act of May 11, 1908	$11,500.00
June 30, 1909, amount expended during fiscal year	10,664.68
July 1, 1909, balance unexpended	835.32
July 1, 1909, outstanding liabilities	835.24
Balance to revert to Treasury	.08

Instruments.

Amount appropriated in the army appropriation act of May 11, 1908	$5,000.00
June 30, 1909, amount expended during fiscal year	4,724.78
July 1, 1909, balance unexpended	275.22
July 1, 1909, outstanding liabilities	275.22

ESTIMATES OF APPROPRIATIONS REQUIRED FOR THE ENGINEER DEPOTS FOR 1910–11.

For incidental expenses of the depots, including fuel, lights, chemicals, stationery, hardware, machinery, pay of civilian clerks, mechanics, and laborers, extra-duty pay to soldiers necessarily employed for periods not less than ten days as artificers on work in addition to and not strictly in the line of their military duties, such as carpenters, blacksmiths, draftsmen, printers, lithographers, photographers, engine drivers, telegraph operators, teamsters, wheelwrights, masons, machinists, painters, overseers, laborers, repairs of, and for materials to repair, public buildings and machinery, and unforeseen expenses	$20,000.00
For purchase and repair of instruments, to be issued to officers of the Corps of Engineers and to officers detailed and on duty as acting engineer officers for use on public works and surveys	10,000.00
Total	30,000.00

(See Appendixes 2, 3, and 4.)

ENGINEER EQUIPMENT OF TROOPS.

By act of Congress approved May 11, 1908, the sum of $72,500 was appropriated for the procurement of ponton material, tools, instruments, and supplies required for use in the engineer equipment of troops in the field, and $343.76 was received during the year by settlements and deposits for property transferred, sold, and lost, making the total amount available $72,843.76. Of this sum $66,326.81 was allotted for disbursement at Washington Barracks, $4,750 at Fort Leavenworth, $53 at Havana, $200 at Honolulu, $850 at Vancouver Barracks, and $658.80 at headquarters Philippines Division. The sum of $5.15 unallotted and 39 cents balance from allotment to Vancouver Barracks, a total of $5.54, reverted to the Treasury.

With these funds engineering supplies were obtained for the various military divisions and departments in the United States, insular possessions, and Cuba; engineer troops were supplied, so far as possible, with the company equipment called for by General Orders, No. 9, Office of the Chief of Engineers, 1906; and the purchase and issue of reconnaissance outfits and intrenching tools to military posts and organizations required by General Orders, No. 113, War Department, 1906; General Orders, No. 73, War Department, 1907; and General Orders, No. 221, War Department, 1907, were continued.

All supplies required by General Orders, No. 221, War Department, 1907, were purchased and delivered, except where the retention of the intrenching tool equipment by organizations had been requested until their return to the United States.

At Washington Barracks considerable additions were made to the ponton and bridge equipment, 16 chess wagons under contract at close of the last fiscal year were delivered, and 50 ponton and 3 tool wagons were contracted for and will be completed in August, 1909. At the close of the fiscal year, practically 2 divisions of reserve ponton equipment and 2 divisions of advance ponton equipment were completed, with the exception of ponton and tool wagons. These, however, are now under contract. Sixteen chess wagons and 1 battery and forge wagon still required will be obtained from new appropriations. Eight wooden ponton boats and other ponton materials were constructed.

At Fort Leavenworth one Rees experimental tool wagon was completed in July and was reported upon December 31, 1908. White pine lumber and other supplies were purchased for the construction of additional reserve and advance guard pontons. All of this material has been delivered, except the white pine lumber, and it is expected that it will be delivered in time to begin work on the new boats in November.

At Vancouver Barracks tools and supplies were purchased for fitting out tool wagons for 1 advance and 1 reserve division with the exception of a few minor articles and the item of canvas. Some oak lumber was purchased for replacing parts of carriages. Tools, photographic supplies, explosives, lumber, etc., were also purchased for the use of the engineer company stationed at Vancouver Barracks.

The army appropriation act of March 3, 1909, provides $90,000 for engineer equipment of troops for the fiscal year 1910. Expenditures from this fund will be made for the purchase of various reconnaissance instruments, drawing materials, photographic supplies, intrenching tools, etc.; purchase of 35 chess carriages, 20 ponton carriages, and 4 tool wagons for the ponton trains, and to purchase of material and manufacture of boats, balks, chess, and other articles pertaining to ponton equipage; to continue investigations looking to improvement of ponton material, and making necessary repairs and renewals to intrenching tools; for experimental development of searchlight for field use, power plant for engineer trains, and new forms of equipment developed from time to time.

At the rate permitted by past appropriations, the work of supplying the army with engineer equipment will take several years for completion. In certain lines of material, definite amounts and specifications have now been adopted and will probably not be changed in the near future. In addition, there are many items of equipment, such as field searchlights, new forms of ponton material, traction for engineer pack trains, etc., on which much development is still needed.

ENGINEER EQUIPMENT OF TROOPS, 1909.

Amount appropriated in the army appropriation act of May 11, 1908	$72,500.00	
Amount received during year by settlements and deposits in payment for property transferred, sold, and lost	343.76	
		$72,843.76
June 30, 1909, amount expended during fiscal year		51,730.28
July 1, 1909, balance unexpended		21,113.48
July 1, 1909, outstanding liabilities		21,107.94
Balance to revert to Treasury		5.54

(See Appendixes 2, 3, and 4.)

CIVILIAN ASSISTANTS TO ENGINEER OFFICERS.

By act of Congress approved May 11, 1908, the sum of $25,000 was appropriated for civilian assistants to engineer officers serving on the staffs of division, corps, and department commanders to enable them to secure the services of surveyors, draftsmen, photographers, master laborers, and clerks during the fiscal year 1909. These funds have been applied to the purpose for which appropriated; the sum of $24,950.31 was expended during the fiscal year 1909, and a balance of $49.69 reverted to the Treasury.

Owing to a marked increase in the mapping work required in the Philippines, and to an increase in the number of chief engineer officers in the United States due to the abolishment of the geographical divisions and the assignment of a chief engineer officer to each military department, additional funds were required for this purpose, and the army appropriation act approved March 3, 1909, contained an item of $40,000 for civilian assistants during the fiscal year 1910. This sum has been apportioned among the various military departments in the United States and the Philippines Division, and will all be required for the operations of the chief engineer officers therein.

An estimate of the same amount, $40,000, for the fiscal year ending June 30, 1911, has been submitted.

CONTINGENCIES, ENGINEER DEPARTMENT, PHILIPPINE ISLANDS.

In the prosecution of work of great importance in the Philippine Islands, in remote and inaccessible localities, the operations of the Engineer Department have been embarrassed by the lack of funds of wide applicability and limited restrictions as to expenditure. Owing to the circumstances under which the work must be performed, an appropriation of this character is essential to its satisfactory prosecution. In accordance with directions from the Secretary of War, an estimate of $5,000 has been submitted for this purpose.

RIVER AND HARBOR IMPROVEMENTS.

Appropriations.—The funds with which the works for the improvement of rivers and harbors were prosecuted during the past fiscal year were derived from the appropriations made by the river and harbor acts approved March 2, 1907, and March 3, 1909, the sundry civil acts approved March 4, 1907, May 27, 1908, and March 4, 1909, from such appropriations as have been provided by other general acts and by special acts of Congress, and from the available balances of former appropriations.

The following works are provided for by permanent appropriations: Removing sunken vessels; operating and care of dredge boats on upper Mississippi River; removing obstructions in Mississippi River; gauging waters of the Mississippi River and its tributaries; examinations and surveys at South Pass, Mississippi River; maintenance of South Pass channel, Mississippi River; operating snag boats on Ohio River; operating and care of canals, etc.; support and maintenance of the Permanent International Commission of the Congresses of Navigation.

Status of works.—Statements derived from the reports of the officers in charge of the various works, and given herewith, set forth the condition of each improvement and the extent of the work performed during the past fiscal year.

Expenditures.—The total amount actually expended under the direction of the Chief of Engineers in connection with the improvement of rivers and harbors during the fiscal year ending June 30, 1909, is as follows:

Rivers and harbors (general, including examinations, surveys, and contingencies)	[a] $31,525,076.39
Removing sunken vessels	49,828.85
Operating snag and dredge boats on upper Mississippi and Illinois rivers	25,000.00
Removing obstructions in Mississippi River	100,021.03
Gauging waters of the Mississippi River and its tributaries	8,888.49
Maintenance of South Pass channel, Mississippi River	119,449.77
Examinations and surveys at South Pass, Mississippi River	9,050.00
Operating snag boats on Ohio River	36,391.95
Operating and care of canals, etc	1,700,458.77
Prevention of deposits in New York Harbor	85,706.17
Mississippi River Commission	[b] 3,052,675.30
California Débris Commission (expenses)	14,269.69
Permanent International Commission of the Congresses of Navigation	3,860.50
International Waterways Commission	22,255.71
Commission on waterway connecting Chesapeake and Delaware bays	352.67
	36,753,285.29

This amount does not include the following:

Enlargement of Governors Island, New York Harbor	$188,533.83
Reclamation of Quarantine Island, Honolulu, Hawaii	2.75
Piers, Hampton Roads, Jamestown Exposition	1,086.40
	189,622.98

---

[a] Includes $594.33 omitted from statement of expenditures for fiscal year 1908.

[b] Does not include $10,000 allotted from "Emergencies in River and Harbor Works," and $8,338.68 under "Gauging Waters of the Mississippi River," included in first statement.

Expenditures have also been made as follows, from funds contributed by States, municipalities, and private parties:

Contributed by citizens of St. Joseph, Mo., for improvement of Missouri River	$4,179.85
Contributed by Twin City Rapid Transit Company and city of St. Paul, Minn., for construction of bridge over Mississippi River at Fort Snelling	95,905.09
Contributed by State of Washington for improvement of Snake River, Wash	26,786.75
Contributed by State of Washington for improvement of Columbia River above Celilo, Wash	11,840.34
Contributed by railroad companies for improvement of Missouri River at Elwood, Kans	13,290.61
Contributed by railroad companies and private interests for improvement of Puyallup Waterway, Tacoma, Wash	61,557.50
Contributed by citizens of Dallas, Tex., for improvement of Trinity River, Tex	6,316.52
Contributed by Cape May Real Estate Company for improvement of Cold Spring Inlet, N. J	2,800.41
Contributed by State of Rhode Island for improvement of Pawtucket River, R. I	19,933.24
Contributed by certain citizens of Oregon, for improvement of Coos Bay	21,270.41
	263,880.72

Estimates.—The following estimates are submitted by the Chief of Engineers for the fiscal year ending June 30, 1911:

Under continuing contracts, including Mississippi River Commission	$9,194,428.00
Rivers and harbors (general, including examinations, surveys, and contingencies)	27,038,037.00
Under California Débris Commission (expenses)	15,000.00
Prevention of deposits in New York Harbor	100,250.00

Engineer divisions.—The engineering works in charge of this office are arranged in divisions, and officers of the Corps of Engineers were assigned as division engineers to overlook these works, as follows:

East of the Rocky Mountains: Northeast Division, Col. John G. D. Knight; Eastern Division, Col. D. W. Lockwood; Southeast Division, Col. Dan. C. Kingman; Gulf Division, Col. E. H. Ruffner to August 31, 1908, Lieut. Col. L. H. Beach since August 31, 1908; Central Division, Col. Wm. T. Rossell; Lakes Division, Lieut. Col. W. L. Fisk; Western Division, Col. W. H. Bixby. West of the Rocky Mountains: Pacific Division, Lieut. Col. John Biddle; Northern Pacific Division, Lieut. Col. John Biddle, temporarily in charge.

Preliminary examinations and surveys.—The river and harbor act of March 3, 1909, provides for preliminary examinations and surveys of certain localities, and the duty of making the same has been assigned to boards of engineers and to officers of the Corps of Engineers in charge of the various engineering districts. Specific reference is made in the following pages to reports already received and transmitted to Congress concerning Point Judith Pond, R. I.; Newark Bay, N. J.; Point Harbor Channel, N. C.; Waverly Creek, S. C.; Indian River, Fla.; Pine Island Sound, Fla.; New River, Fla.; Arkansas River at Douglas, Ark.; Blackfish Bayou, Ark.; Little Black River, Ark. and Mo.; and Feather River, Cal., to Marysville. Reports concerning the other localities will be duly submitted when received.

Itemized statement of expenditures during the fiscal year ending June 30, 1909, under section 14 of the river and harbor act of March 3, 1909, submitted in compliance with the requirements of said law.

Number, designation, and time employed.	Rate.	Amount.
One assistant engineer, April 24 to June 30	p. a. $3,600	$670.00
One law officer, March 26 to June 30	p. a. 2,500	659.72
One draftsman, April 7 to June 30	p. a. 1,800	420.00
One clerk, May 6 to June 30	p. a. 1,400	213.90
One carpenter, March 24 to May 15 (45 days)	p. d. 4.00	180.00
Three laborers, March 23 to April 13 (17⅞ days each)	p. d. 1.50	80.43
One laborer, March 23 to April 1 (8⅜ days)	p. d. 1.50	12.56
One laborer, April 3 to April 13 (8¼ days)	p. d. 1.50	12.37
Four laborers, April 21 to April 26 (4⅜ days each)	p. d. 1.50	26.24
Total		2,275.22

IMPROVEMENT OF RIVERS AND HARBORS IN THE PORTLAND, MAINE, DISTRICT.

This district was in the charge of Lieut. Col. Geo. A. Zinn, Corps of Engineers. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. *Lubec Channel, Maine.*—This channel lies between the eastern extremity of the State of Maine and Campobello Island, Canada.

Originally the depth was about 5 feet at mean low tide and 2 feet at low water of spring tides. At and near low tide vessels were unable to navigate the passage and were obliged to take a route about 10 miles longer, through Canadian waters, to reach Lubec, Eastport, Calais, Pembroke, and other ports in Maine on the St. Croix and Pembroke rivers.

A project was adopted in 1879 which, as subsequently modified, provided for a channel 275 feet wide, increasing to 300 feet in the bends, and 12 feet deep at mean low tide. This project was completed in 1890, practically as proposed, at a cost of $168,954.68.

The present project was adopted August 18, 1894, and its object was to widen the then existing channel to a least width of 500 feet, at an estimated cost of $150,000. The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1909, was $138,478.30. At the latter date the channel had been dredged to the full projected width and depth contemplated by the project of 1894. The work will probably be reasonably permanent, but examinations will have to be made from time to time, when opportunity offers, to determine this question.

The maximum draft that can be carried is about 11.5 feet at mean low water; the mean variation in tide level is 18.2 feet. The channel, which is about 3 miles long, connects the roads above with the Atlantic Ocean, and is the convenient and direct approach to Lubec, Eastport, and St. Croix River from the westward. It is an international passage, and the benefits from the improvement are almost entirely general. As the tidal currents are very strong and dense fogs prevail a large part of the time, the widening of the passage decreases the chances of stranding and collision.

It is impracticable to make a definite statement covering the navigation using the channel, but the tonnage for the calendar year 1908, for the town of Lubec, at the head of the passage, is given as 56,370 tons, having an estimated value of $1,400,000, the chief items being canned goods (principally sardines), fish, and coal, in the order named. The chief effect on freight rates probably arises through the competition afforded by a direct line of steamers to Portland and Boston, the railroads giving the public lower rates to points having water lines of transportation.

For reports on examinations and surveys see page 279, Annual Report of the Chief of Engineers for 1879, and page 616, report for 1891.

There were no expenditures during the fiscal year 1909.

July 1, 1908, balance unexpended	$11,567.02
July 1, 1909, balance unexpended	11,567.02

(See Appendix A 1.)

2. *Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me.*—The object of the breakwater is to protect the wharves of Bar Harbor and the anchorage in front of the town from the heavy seas of southerly gales.

The act of August 11, 1888, made an appropriation for commencing the work. The project was modified in 1893 as to length of breakwater, and now provides for a structure of riprap stone, extending from Porcupine Island 2,500 feet in a westerly direction to a point about 600 feet from the low-water line on Mount Desert Island. The top of the breakwater is to be at the level of mean high tide, 20 feet wide, and the side slopes such as the rock assumes—about 1 on 1. The estimate of cost was based on the expectation that 382,000 tons of stone would be required, and was placed at $420,200.

The expenditures to June 30, 1909, were $219,559.61. There was no work in progress during the fiscal year 1909, the expenditures practically representing payments for contract work completed the previous year.

The breakwater has been built to full section for a length of about 1,859 feet, leaving about 641 feet yet to be constructed; the total quantity of stone deposited to the present time is 211,534 tons.

The tonnage for the calendar year 1908 is reported as about 332,000 tons, with an estimated value of $4,774,890. The great increase in quantity is explained as chiefly due to the erection of several large brick and stone buildings, the materials for which were received by water.

The beneficial effects resulting from the portion of the breakwater already built in protecting the wharves at Bar Harbor and the anchorage basin, which is extensively used by costly pleasure craft during the summer season, are appreciably felt, but in order to secure the desired protection at high water of spring tides it may be found necessary to raise the breakwater to a height of about 6 feet above mean high tide. The mean range in tides is 11.5 feet.

The benefits to navigation are general in providing a harbor of refuge, and local in making it possible for boats to land at the wharves at all times with safety. The only convenient method of transportation to and from Bar Harbor is by boat.

The new appropriation estimated for is to be applied in extending the breakwater, in accordance with the project.

For report on examination and survey, see Annual Report of the Chief of Engineers for 1887, page 481.

July 1, 1908, balance unexpended	$13,997.30
June 30, 1909, amount expended during fiscal year for works of improvement	13,556.91
July 1, 1909, balance unexpended	440.39
Amount (estimated) required for completion of existing project	200,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 2.)

3. Harbor at Sullivan Falls, Maine.—Sullivan River has a length of about 6 miles and is the outlet of a large bay. About midway of its length a point of land projects to such extent as to reduce the width to about one-fourth that immediately above and below, and at this place the slope and velocity are such that the locality is termed "Sullivan Falls." The bottom is ledge, the higher portions forming dangerous obstructions to navigation. Hatchers rock, about midway of the narrow channel at the falls, had originally only about 6 inches of water over it at mean low tide. The mean range in tides is 11.5 feet.

Under a project set forth in report of the district engineer dated December 10, 1870, and under appropriations based thereon, the sum of $35,000 was expended in removing three old piers, in excavating the obstructing ledges at the falls to a depth of 7 feet at mean low tide, and in replacing spindles on two rocks near the mouth of the river. This work was completed in 1875 and was of material benefit to navigation.

The present project is that referred to in the river and harbor act of June 3, 1896, as the "approved project," and published in the Annual Report of the Chief of Engineers for 1891, page 619. It provides for removing Hatchers rock and two other points of ledge to a depth of 10 feet at mean low tide, at an estimated cost of $35,000.

The expenditures under the existing project to June 30, 1909, were $14,870.64, and the operations consisted in removing the entire area of Hatchers rock and about five-sixths of ledge "C" to a depth of 10 feet at mean low tide. About 70 per cent of the work covered by the project has been completed.

To complete the present project the remaining part of ledge "C," containing about 67 cubic yards in situ, and ledge "B," containing 255.3 cubic yards in situ, will have to be removed.

The improvement not only increases the navigable depth, but also, by removing the cause of eddies and cross currents, has added to the length of time at each high and low tide during which vessels may pass through the rapids with safety.

Vessels can not use the channel at low stages except when the tide is slack. This occurs after the tide has flowed about 2 feet, at which time vessels drawing 11 feet can pass through safely.

The improvement may be regarded as permanent.

The commerce for the calendar year 1908 is given as 59,300 tons, with an estimated value of $64,150. It is nearly all granite. The improvement is reported as affecting freight rates by improving the channel, but definite figures in this respect are not available.

It is proposed to apply the new appropriation estimated for in continuing the rock excavation in accordance with the project.

For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1871, page 836; and page 619, report for 1891.

July 1, 1908, balance unexpended	$129.36
June 30, 1909, carried to the surplus fund	129.36
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 3.)

4. Union River, Maine.—The navigable portion of the river extends from the head of Union Bay to the foot of the falls at Ellsworth, a distance of about 3¾ miles.

Before improvement the channel was obstructed by a large deposit of slabs, edgings, and sawdust near Ellsworth, which practically suspended navigation except at high tide, by projecting ledges in the Narrows about three-fourths of a mile below the wharves at Ellsworth, by bowlders at several points along the channel, and by a broad, flat bar of sawdust and mud at the mouth.

The first project for the improvement of the river is contained in the report of the district officer dated June 30, 1867, and provided for erecting beacons, removing sunken ledges and bowlders, and dredging mill waste near Ellsworth, so as to secure a depth of 3 feet at mean low tide, this being the available depth on the bar at the mouth of the river. This improvement was completed in 1873 with an expenditure of $30,000.

A survey was made in 1889 under the provisions of the act of 1888, and a new project was submitted with a view to obtaining a depth of 6 feet at mean low tide from the wharves at Ellsworth to deep water in the bay. This depth was to be obtained by dredging mill waste near Ellsworth, by removal of ledge in the Narrows, and by dredging across the bar at the mouth of the river. To maintain the improved depth at the latter point, the same project provided for the construction of a training wall to concentrate the ebb flow in the channel. The project is described on page 462, Part 1, Annual Report of the Chief of Engineers for 1890, and was estimated to cost $225,000.

The act of June 3, 1896, appropriated $15,000 for improving the river, by dredging, and as $145,000 represented the estimated cost of the dredging operations under the project submitted in 1890, that sum was adopted as the estimated cost, and the project was taken to cover the dredging only. Serious movements of the mill waste in the river obliterated some of the work; some modifications were afterwards made; and in 1902, when funds were practically exhausted, the results secured were a channel depth of 6 feet at mean low tide up as far as the vicinity of Ellsworth and a channel 4 feet deep at mean low tide at the latter locality. Expenditures under this project were $142,601.36.

In 1908 an examination indicated that there had been some shoaling at the mouth of the river, and to a greater degree near Ellsworth. In the other portion of the river the work had practically maintained. The erection of a new large dam at the head of navigation rendering it unlikely that any more material would come down from the deposits above, in April, 1909, an allotment of $15,950 was made from the appropriation for preservation and maintenance of river and harbor works provided by the river and harbor act of March 3, 1909, for the purpose of restoring the conditions of 1902. The expenditures under the latter allotment have been $103.19. The work was advertised, and a contract is now being made with a view to completing the dredging during the present working season.

The mean range of tide is 10 feet. At mean low tide only about 1 foot can be carried to the wharves at Ellsworth. The dam near Ellsworth is without a lock, and navigation is limited to that point. There is some logging on the river above, but it is no longer extensive.

The commerce by water for the calendar year 1908 is reported as 8,660 tons, chiefly coal, cooperage, and lumber. The estimated value of the commodities is placed at $57,119. It is stated that, while receipts and shipments by water have been decreasing in the last few years, the business for 1908 was unusually small, and that the shipments for the first half of 1909 will probably exceed those for the entire year 1908.

For reference to reports on examinations and surveys, see page 30, Annual Report for 1908.

July 1, 1908, balance unexpended	$2,512.65
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,950.00
	18,462.65
June 30, 1909, amount expended during fiscal year for maintenance of improvement	217.20
July 1, 1909, balance unexpended	18,245.45

(See Appendix A 4.)

5. *Bagaduce River, Maine.*—This is a small stream that empties into Penobscot Bay at Castine, Me. The upper part of the river divides into two branches, one called Northern Bay and the other South Bay. Northern Bay, near South Penobscot, is a shoal sheet of water of about 700 acres area, the bottom of which for the greater part is bare at low tide. Before improvement there was a narrow channel from Bridges Point to Bowden's wharf, which had a depth of less than 2 feet and was obstructed by ledges and bowlders near Winslows Island. The South Bay is obstructed by ledges at Johnsons Narrows. Mean rise and fall of tide, 9.8 feet.

The approved project is understood to be that published at page 398 of the Annual Report of the Chief of Engineers for 1888. Its object is to secure a channel 100 feet wide and 6 feet deep at mean low tide from Bridges Point, Northern Bay, to Bowden's wharf, at an estimated cost of $45,000. The same project provides for removing a small quantity of rock in the channel at Johnsons Narrows, at an estimated cost of $1,875. All work done has been in accordance with this project. About one-third of the work covered by the project may be said to have been completed.

The expenditures to June 30, 1909, were $28,000. At that date there had been made, by dredging and the removal of rocks and bowlders, a channel 40 feet wide and 6 feet deep at mean low tide, except at Winslows Island, where a depth of only 4 feet has been secured. The total length of channel is about 4,000 feet.

The improvement has been regarded as of doubtful public value.

There were no expenditures during the fiscal year 1909, and there was no work in progress.

From the mouth of the river at Castine to the head of navigation, in Northern Bay, is about 9 miles.

The tonnage for 1908 is given as 117,795 tons, but this includes the business of Castine, at the mouth of the river. The commerce for that part of the Bagaduce covered by the project for improvement is put at 29,030 tons, the chief commodities, in weight, being bricks, clay, lumber, wood, and grain, with a total estimated value of about $400,000.

The new appropriation recommended is for continuing the excavation of the channel at Winslows Island.

For reports on examinations and surveys, see Annual Reports of the Chief of Engineers for 1888, page 398; 1893, page 724; and 1898, page 842.

Amount (estimated) required for completion of existing project........	$18,875.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement..................................	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 5.)

6. *Penobscot River, Maine.*—Except the dredging of a sawdust bar opposite High Head, near Bucksport, Me., the improvements have been confined to a stretch of about 3½ miles of the river at and below Bangor. Before improvement this part of the river was obstructed by ledge, bowlders, and mill waste to such extent as to afford a safe available depth of only about 6 feet at extreme low tide. The mean range in tides is 13.1 feet.

The head of navigation is at Bangor; from thence to the head of the bay is about 27 miles.

The first project was approved August 22, 1870, and called for a depth of 12 feet at lowest tides for a width of 150 feet over 3½ miles of river at and below Bangor. There was expended $198,300.

In 1884 a project was adopted for widening the channel at Bangor and for certain improvements in the river below, near Crosbys Narrows. An addition was afterwards made providing for a 22-foot depth between Bucksport and Winterport. After a survey, ordered by the act of September 19, 1890, the project was modified and extended so that it included a depth of 11 feet at extreme low tide for a width of 360 feet in Bangor Harbor; to widen, straighten, and deepen the channel near Crosbys Narrows and near Sterns mill to a depth of 12 feet at extreme low tide, and to secure a channel depth of 22 feet at mean low tide between Bucksport and Winterport. The estimated cost of the entire work was placed at $440,000. March 3, 1899, the project was again extended by providing for removal of ledge in front of the Boston and Bangor Steamboat Company's wharf at Bangor and for deepening the basin of Kenduskeag stream at its junction with the Penobscot, and $28,000 was appropriated for the work. The results aimed at by the project of 1884 and the subsequent additions are regarded as practically accomplished, and the cost has been $169,500, a total expenditure down to this time of $367,800.

By the act of March 2, 1907, Congress adopted a further project for an additional width at Bangor, varying from 100 to 300 feet, for a length of nearly 2,000 feet, the depth to be 11 feet at extreme low tide (14 feet at mean low water). The estimated cost of this work is $130,000. The amount expended on the work of the existing project to June 30, 1909, is $1,724.01. The work has been placed under contract, and at the close of June, 1909, a considerable area had been worked over, and about 6,000 cubic yards of material, scow measurement, had been taken up, but as the area has not yet been swept to determine whether or not the full depth has been secured, accurate information as to the real progress is not available.

The least depth over the area now being excavated is about 9 feet at mean low tide, but the prevailing channel depth at Bangor is 14 feet. Elsewhere in the river the depth is greater. While Bangor, where there is a dam without a lock, is the head of navigation, the river above is extensively used for floating logs down from the upper waters.

The tonnage for calendar year 1908 is given as 552,332 tons, of which 267,400 tons was coal and 150,000 tons lumber. The value of receipts and shipments is estimated at about $3,411,925.

For list of examinations and reports see page 32, Annual Report of the Chief of Engineers for 1908.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$8,500.00
July 1, 1909, balance unexpended	8,500.00

AT BANGOR.

July 1, 1908, balance unexpended	$128,891.31
June 30, 1909, amount expended during fiscal year for works of improvement	615.32
July 1, 1909, balance unexpended	128,275.99
July 1, 1909, outstanding liabilities	200.00
July 1, 1909, balance available	128,075.99
July 1, 1909, amount covered by uncompleted contracts	124,900.00

(See Appendix A 6.)

7. *Rockland Harbor, Maine.*—The wharves are located on the shores of three coves, formed by two projecting points of land on the western side of the harbor, known as Crocketts Point and Atlantic Point. The general direction of the wharf frontage is north and south, and the length of frontage is about 800 feet. Before improvement depths in front of the wharves increased very slowly. All the wharves except those at the end of Crocketts Point and Atlantic Point extended only a short distance beyond the low-water contour, a high mean range in tide, which at this point is 9.6 feet, being relied upon to give access to moderate and light draft vessels at high tides. The entrance to the harbor from the east has a width of about 9,000 feet.

Before improvement the anchorage in front of the wharves, vessels lying at the wharves, and the wharves themselves were endangered by heavy seas during easterly gales.

The first improvement undertaken was to render it a safe harbor of refuge for coastwise shipping, and incidentally also to protect the wharves as far as possible from heavy seas. To accomplish this a project was adopted in 1881 in which two breakwaters were contemplated, one extending south from Jamesons Point, the other a detached breakwater nearer to and opposite the principal wharves in the town, both to be raised in the first instance to the level of mean tide, but with the expectation that a further raising would be necessary as experience might dictate.

In 1886 this project was amended so as to raise the height of the breakwater at Jamesons Point to the level of mean high tide. In 1890 it was again amended so as to eliminate the detached breakwater and to provide for extending farther south than was first contemplated the breakwater at Jamesons Point.

By the act of June 3, 1896, Congress adopted a project for dredging the inner harbor in the vicinity of the wharves to depths ranging from 4 feet to 13 feet at mean low tide and for removing two dangerous ledges, one occupying a central position in the harbor, which was to be cut down to the depth of 22 feet at mean low tide; the other, less centrally located, was to be removed to a depth of 14 feet. The estimated cost was $402,000. By the same act this project was combined with that for the breakwater as one project, and authority was given for completing the whole under the continuous-contract system, at an estimated expenditure of $1,036,000.

The appropriations for the above work have aggregated $925,500. The total of expenditures to the close of the fiscal year ending June 30, 1909, is $920,025.79. As a result the project has been completed, subject to any work that may be needed from time to time until the slopes of the breakwater, which is about 4,140 feet in length, have assumed a condition of definite permanence. The benefits resulting are that the breakwater affords a safe and extensive anchorage and harbor of refuge. The removal of ledges has increased the available anchorage area, and the dredging affords access to the wharves by vessels of greater draft.

There was no work during the fiscal year 1909. The business by water for the calendar year 1908 amounted to 493,950 tons, of which 235,000 was lime and 100,000 tons coal. The value of the commodities has been estimated at $2,494,580. It is impracticable to definitely state the direct effect on freight rates. Aside from the advantage arising from competitive water transportation freight charges by water have been subject to reduction through economies made possible by the use of larger vessels.

July 1, 1908, balance unexpended..	$5,474.21
July 1, 1909, balance unexpended..	5,474.21

(See Appendix A 7.)

8. *Sasanoa River, Maine.*—Originally this stream was much obstructed in the vicinity of Upper Hell Gate. The channel at and near that place was crooked and narrow and was obstructed by dan-

gerous ledges, the shoalest of which had not more than 3 feet of water over it at mean low tide.

Between 1870 and 1881 the sum of $45,500 was appropriated, and the navigation was much improved by rock excavation, dredging, and the construction of a small jetty.

By act of June 3, 1896, a new project was adopted for widening the channel at Upper Hell Gate to 125 feet, with a depth of 12 feet at mean low tide, by ledge excavation; for dredging to the same depth at Carletons ledges, and for constructing a small jetty at the Camp Ground, at an estimated cost of $19,000, which amount was appropriated by the same act. This project was completed in 1898 at a cost of $11,987.69.

The present project, submitted by the Board of Engineers for Rivers and Harbors February 7, 1907, is to increase to a width of not less than 140 feet the channel 90 feet wide made under the first project through the ledges southeastwardly of Upper Hell Gate, and to remove Flat rock, all to the depth of 12 feet at mean low tide. This project was adpoted by the act of March 2, 1907, which contained an appropriation of the entire estimated cost, viz, $44,000.

Expenditures under the existing project to June 30, 1909, have been $33,788.90.

During the fiscal year the work of excavating ledge was continued, and the project of 1907 was completed. The Sasanoa is a tidal river or thoroughfare, about 9 miles in length, connecting the Kennebec River at Bath, Me., with Sheepscot River. It is the usual route of travel to Booth Bay Harbor, a place of considerable importance, and in the summer the travel is much increased by the large number of summer residents at Squirrel Island and other resorts in that vicinity. It is navigable throughout its entire length and has about 12 feet depth at mean low tide over the shoalest parts. The mean range of tide in the vicinity of the last improvement is about 8.5 feet. The work recently completed has resulted in giving practically a straight channel 140 feet wide where the width was formerly 90 feet. By reducing the current it has made the straight channel easily navigable, while before it was regarded as difficult, and vessels used a crooked channel to the westward of Green Island, where there was less current. The increase in discharge capacity and elimination of some of the cross currents has improved the conditions in the westerly channel also.

The business for 1908 is given as 3,896 tons, having an estimated value of $274,195. The number of passengers carried was 73,537.

The effect on freight rates can not be stated in a definite way, but the improvement permits the use of larger vessels necessary to accommodate the increasing travel and renders the passage less dangerous.

For reports on examinations and surveys see Annual Reports of the Chief of Engineers for 1867, page 499; 1895, page 953; for map, report for 1880, page 334.

July 1, 1908, balance unexpended	$37,769.13
June 30, 1909, amount expended during fiscal year for works of improvement	27,558.03
July 1, 1909, balance unexpended	10,211.10
July 1, 1909, outstanding liabilities	100.00
July 1, 1909, balance available	10,111.10

(See Appendix A 8.)

9. *Kennebec River, Maine.*—Before improvement the main channel of the river between the foot of Swan Island and Gardiner was obstructed by shoals near Beef rock, with only 10 feet of water at mean low tide, by dangerous sunken ledges in Lovejoy Narrows, by a shoal below South Gardiner, with only 8 feet on it at mean low tide, and by a ledge at Nehumkeg Island. The steamboat channel to the west of Swan Island (at Hatchs rock) was obstructed by a shoal over which there was only 7½ feet of water, and the channel between Gardiner and Augusta, a distance of 6½ miles, was obstructed by shoals which gave a navigable depth of only 3½ feet in low summer tides.

Appropriations for minor improvements were made at various times between 1827 and 1852.

In 1866 a project was begun for improving the upper part of the river, with a view to obtaining a channel 7 feet deep and 100 feet wide at low water. This project, with modifications, was completed in 1877, and resulted in obtaining a channel 10 feet deep at mean low tide and not less than 100 feet wide as far up as Gardiner, and a depth of 6½ feet at low tide and width of 100 feet from Gardiner to Augusta.

The channel west of Swan Island, being obstructed by shoal water (8½ feet at mean low tide) and a too narrow channel at the head of the island, by shoal water at Hatchs rock, below Richmond, and by a very narrow channel 30 feet wide at the foot of the island, was improved by dredging in 1881–1883, so as to give a channel 175 feet wide and 11 feet deep at the foot of the island and a channel of about 80 feet width and 10 feet depth at Hatchs rock and the head of the island.

The river and harbor act of 1886 provided for a new survey of the river from Bath to Augusta. This survey was made in 1887, and a project embracing dredging, rock excavation, and contraction works was submitted for the further improvement of the river. In 1892 this project was revised to secure depths as follows: Thirteen feet at mean low tide as far up as Sands Island, 12 feet thence to Hinckleys shoal, above Gardiner, and 10 feet thence to Augusta, at an estimated cost of $388,500. This project was approved August 19, 1892, and was essentially completed in 1898.

The improved channel obtained under the above projects suffered some loss of available depth by the deposits brought down by freshets. This shoaling was most marked in the stretch of 6½ miles of river between Gardiner and Augusta, the further improvement of which was provided for by the river and harbor act approved June 13, 1902, which appropriated $40,000 and authorized a continuing contract for the completion of the project. The last project is published at page 1121 of the Annual Report of the Chief of Engineers for 1900, and proposes a widening of the channel from Gardiner to Augusta to 125 feet and a cleaning out of the old dredged channel and its further deepening to 16 feet at mean high water, or 11 feet at mean low water.

The total estimated cost of the project of 1902, which was $81,000, has been appropriated, and the project was completed November 28, 1908.

The total of expenditures under the above projects is $590,411.03.

A project for improvement between the mouth and Gardiner was adopted by the river and harbor act of March 2, 1907, and is designed to obtain, by dredging and ledge excavation, channels through the shoals between the foot of Swan Island and Gardiner at least 150 feet wide and of such depths that for a vessel passing up the river at the usual speed on the flood tide and timed to reach Gardiner at high water the available depth would at no point be less than 20.5 feet. The depth over ledge is to be 1 foot greater than this. Two training walls are to be repaired and one of them lengthened 700 feet. The cost of the project is estimated at $275,000.

The act of 1907 placed the project under the continuing contract system, and by that and subsequent acts $231,500 has been appropriated, leaving $43,500 yet to be provided.

Expenditures to June 30, 1909, under the project of 1907 have been $72,298.82. Operations during the last fiscal year are regarded as new work, and have included the extension and repair of jetties, under contract, which has been completed. The work of dredging, under contract, was also continued throughout the year, except for the winter season, and about 32 per cent of that work has now been accomplished. The ledge excavation has recently been placed under contract, and that work also has been commenced. All the work necessary for completion of the project is now under contract.

While some advantage arises from increased depths as the work advances, the measure of such will be limited until further progress has been made.

The mean rise and fall of tides at Bath is 6.9 feet; at Gardiner, 5.1 feet; at Augusta, 4.3 feet. Augusta is the head of navigation and is about 44 miles above the mouth of the river. Above that point the stream is practically devoted to water power and lumbering operations. Over the shoalest part of the river between the mouth and Gardiner, which is the portion covered by the existing project, about 12 feet can be carried at mean low tide.

The commerce for 1908 amounted to 377,238 tons, chiefly ice, coal, and lumber, having an estimated value of $1,379,962.50. It is expected that a considerable increase will be shown next year, as last winter more ice was harvested than for a number of years.

While the use of the river for transportation purposes has some value in a competitive way, the principal effect on freight rates is due to the increased depths which permit the use of larger vessels and larger cargoes in handling such commodities as coal, ice, and lumber, which demand cheap transportation.

It is proposed to apply funds asked for in continuing the improvement of the river from the mouth to Gardiner under existing contracts.

For reports on examinations and surveys see Annual Reports of the Chief of Engineers for 1867, page 488; 1881, page 479; 1888, page 412; 1892, page 541; and 1900, page 1121, and House Document No. 321, Fifty-ninth Congress, second session.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$12,500.00
June 30, 1909, amount expended during the fiscal year for works of improvement	10,833.51
June 30, 1909, carried to the surplus fund	1,666.49

BETWEEN GARDINER AND AUGUSTA.

July 1, 1908, balance unexpended	36,691.30
June 30, 1909, amount expended during the fiscal year for works of improvement	36,691.30

FROM THE MOUTH TO GARDINER.

July 1, 1908, balance unexpended	$150,945.05
Amount appropriated by sundry civil act approved March 4, 1909	70,000.00
	220,945.05
June 30, 1909, amount expended during fiscal year, for works of improvement	61,743.87
July 1, 1909, balance unexpended	159,201.18
July 1, 1909, outstanding liabilities	15,572.39
July 1, 1909, balance available	143,628.79
July 1, 1909, amount covered by uncompleted contracts	167,867.51
Amount (estimated) required for completion of existing project	43,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	43,500.00

(See Appendix A 9.)

10. Portland Harbor, Maine.—The entrance to the main part of the harbor of Portland, or the anchorage, has always been good, but before improvement the approach to the inner harbor was obstructed by a shoal known as the Middle Ground, over which the depth was only from 8 to 10 feet at mean low tide, while between it and Stamford ledge the greatest available depth was only 16 feet. The best part of the wharf front was exposed to swell from the main entrance, which sometimes made it dangerous for vessels to lie at the docks, and along this front the depth was in some places as shallow as 4 feet.

The first work of improvement undertaken by the Government was the construction of the breakwater. This was begun as early as 1836. It was completed in 1874.

The work of deepening the harbor was begun under the act of Congress of 1868, the plan of improvement being to excavate a channel 300 feet wide and 20 feet deep at mean low tide through the southern slope of the Middle Ground and to remove the bar off the Grand Trunk Railroad wharves to the same depth.

The project was modified in 1870 so as to provide for a channel 400 feet wide, and again in 1871 so as to provide for a channel 500 feet wide. In 1872 further modifications were made by including in the project the dredging of Back Cove and the dredging of the inner harbor up to the harbor commissioner's lines to a depth of 16 feet at mean low tide. The project, modified as above described, excepting some dredging in the inner harbor, was completed by 1876. Between 1881 and 1885 the Middle Ground was removed to a depth of 21 feet at mean low tide.

A further deepening of a portion of the harbor to 29 feet at mean low tide was next begun under the project of 1886. To this was subsequently added, in 1890, a small amount of dredging in the upper part of the harbor.

In 1894 the project was extended to cover the widening of the upper part of the 29-foot area and the dredging of a channel 25 feet deep to connect the deep water in the lower part of the harbor with deep water in the upper part. This work was completed in 1894.

By the act of June 3, 1896, Congress adopted a project for dredging to 30 feet at mean low tide over the greater part of the harbor, at an estimated cost of $770,000, and included in the project the further improvement of Back Cove at a combined estimate of $946,250. The same act appropriated $20,000 for beginning work, and authorized the making of a contract for its completion.

The latter project was completed in 1902, at a cost which was about $253,000 less than the estimate. By the sundry civil act of March 3, 1905, Congress authorized an amendment to the project by which the 30-foot channel was to be continued up Fore River as far as the Boston and Maine Railroad bridge, a channel of entrance to Back Cove dredged to the same depth, the width in each case to be about 300 feet, and a small area on the south side of the harbor, in front of the old dry dock, also to be dredged.

Expenditures to the close of the fiscal year ending June 30, 1909, have been $1,512,388.59—$576,477.05 under former projects and $935,911.54 under the existing one. All the projects have now been accomplished, including the amendment of that of 1905, which was completed in September, 1908. Appropriations have been made to the extent of the authorization of 1896; all expenditures have been for new work.

There are no silt-bearing streams emptying into Portland Harbor, and the improved depths obtained under the project will be practically permanent. The maximum draft that can be carried to the wharves in Portland Harbor at mean low tide is 30 feet and to the wharves in Back Cove about 11 feet. The mean range in tide is 8.8 feet.

Two principal advantages have followed this large improvement. A large and well-sheltered deep-water anchorage has been created under the shelter of the breakwater, and the trans-Atlantic vessels can arrive and depart from their docks at the lowest stages of tide.

The portion of the harbor in which most of the dredging has been done is the lower part of so-called Fore River. This river is crossed by four bridges. Going up the harbor these are: (1) Portland bridge; (2) bridge of the Boston and Maine Railroad, Eastern Division; (3) Vaughan bridge, belonging to city; (4) bridge of Boston and Maine Railroad, Western Division. Portland bridge has a draw 65 feet wide and admits vessels of the largest class coming to Portland. The next bridge has a draw opening of 60 feet, and the city of Portland has recently reconstructed the third bridge with openings of not less than 60 feet. The improvements in the bridges and the new channel afford great relief to the coal trade and other deep-draft commerce, which was formerly much hampered and retarded by lack of room and sufficient water.

The commerce for 1908 is given as 2,932,517 tons, of which more than one-half was coal. The value of the commerce is estimated by the shippers as $86,054,108.99.

It is impracticable to make a definite statement as to the effect of the improvement on freight rates, but a large trans-Atlantic business has been greatly helped, and the capacity of the harbor has kept pace with the increase in size and draft of vessels used in the coal traffic, with the accompanying saving in cost of transportation.

For reports on examinations and surveys, see Annual Reports of the Chief of Engineers for 1886, page 541; 1893, page 735; 1901, page 1009, and House Document No. 445, Fifty-ninth Congress, first session, and No. 896, Sixtieth Congress, first session.

July 1, 1908, balance unexpended	$42,228.30
Received from sales	6.00
	42,234.30
June 30, 1909, amount expended during fiscal year, for works of improvement	31,886.84
July 1, 1909, balance unexpended	10,347.46
July 1, 1909, outstanding liabilities	37.50
July 1, 1909, balance available	10,309.96

(See Appendix A 10.)

11. Saco River, Maine.—In its original condition Saco River had a very winding course, with abrupt bends and narrows, which, with its sunken rocks and ledges, presented many difficulties of navigation. The depth on the bar was only 2 feet at mean low water.

The original projects appear to have been—

(1) From 1824 to 1827, for the erection of piers, placing beacons and buoys, and removing obstructions near the entrance to the harbor. Under this project 12 piers of timber and stone were built, 10 in the river to mark sunken rocks and to facilitate navigation by sailing vessels, and 2 outside the mouth designed, but without success, to create a channel through the bar. The construction and maintenance of these works cost, 1824–1827, $12,000.

(2) Adopted by the act of June 23, 1866, to construct a breakwater 2,915 feet long connecting the two outside piers, and to repair the river piers and improve the channel. Under this project, completed in 1874, the channel in the river and through the bar was improved, and a breakwater built on the north side of the channel 4,200 feet long and 10 feet high above mean low water, at an expense of $162,271.75.

The existing project is the consolidation by the act of September 19, 1890, of the project adopted in 1884 for repairing the breakwater, extending it 2,200 feet to Sharps ledge, building a stone jetty on the south side of the channel, and dredging between the jetties, at an estimated cost of $356,500; and the project adopted in 1886 for improving the river to Saco, 5 miles above its mouth, to the depth of 6 feet at mean low water, estimated to cost $50,000, amounting to $406,500. About 43 per cent of this project has been completed, i. e., all except the extension of the breakwater to Sharps ledge, which is estimated to cost $200,000 and upon which no work has been done. In order to maintain the desired depth the extension of this breakwater will be necessary to stop the influx of sand from the north. Possibly the full extension proposed will not be required.

To June 30, 1909, there had been expended on the consolidated project $172,258.37. The depth on the bar at the mouth of the river is about 3½ feet at mean low tide. The depth of 6 feet in the river above appears to have been maintained.

The mean range of tides is 8.8 feet.

The head of navigation is at Saco and Biddeford, on opposite sides of the river, to which towns, about 5 miles above the bar, the river is navigable in fact. The stream above is devoted to water-power development and a small amount of lumbering.

The commerce for 1908 amounted to 44,074 tons, chiefly coal, of an estimated value of $216,517. The freight rates on coal are probably affected by the existence of water transportation, but it is believed that with a greater depth, permitting the use of larger vessels, a reduction in rates could be had which would operate to greatly increase the tonnage.

It is proposed to apply the appropriation recommended to extending the breakwater toward Sharps ledge, with the view of securing greater depth over the bar at the mouth of the river.

A description of the harbor and of the earliest improvement is published in the Annual Report of the Chief of Engineers for 1866, page 188. The present project for improvement at the river's mouth is published in the report for 1884, page 484, and for improving the river above the bar in the report for 1886, page 552.

July 1, 1908, balance unexpended	$5, 241. 63
July 1, 1909, balance unexpended	5, 241. 63
Amount (estimated) required for completion of existing project	200, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	40, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 11.)

12. Cape Porpoise Harbor, Maine.—Originally the harbor had a depth of about 13 feet at mean low tide, but for a small area only, and the entrance was obstructed by a bar on which there was only about 10 feet of water at mean low tide. The anchorage was too small to accommodate the craft seeking the harbor for refuge only, aside from the local commerce.

Under a project adopted March 3, 1899, a channel of entrance 200 feet wide and 16 feet deep at mean low tide and an anchorage area about 3,000 feet long, 600 feet wide, and 15 feet deep at mean low tide were secured by the close of the fiscal year 1902, under an outlay of $72,501.15.

A new project was adopted by the act of March 2, 1907, to deepen and straighten the outer entrance channel, which was narrow and crooked, so as to give a depth of 18 feet at mean low tide for a width of 200 feet. The estimated cost was $46,000, and that amount was appropriated by the act of 1907. The amount expended on the existing project to the close of the fiscal year 1909 is $43,692.80. The work consisted entirely of ledge excavation. At the close of the last fiscal year about 80 per cent of the area had been drilled and blasted. On the 4th of December, 1908, the work was completed, giving a straight outer entrance channel about 190 feet wide and 18 feet deep at mean low tide. The total excavation amounted to 3,999 cubic yards, measured in place. It was done under contract.

The mean range of tide is 8.8 feet.

No commercial statistics have been obtained, but the commerce amounts to about 50,000 tons, chiefly bricks, clay, and coal.

While the improvement may incidentally have an effect on freight rates, the principal benefit consists in straightening and making easier a crooked entrance, difficult and dangerous in fog and storm.

For reports on examinations and surveys see Annual Reports of the Chief of Engineers for 1895, page 583; for 1899, page 1050, and House Document No. 191, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended	[a]$44,436.57
June 30, 1909, amount expended during fiscal year for works of improvement	42,129.37
July 1, 1909, balance unexpended	2,307.20
July 1, 1909, outstanding liabilities	102.13
July 1, 1909, balance available	[a]2,205.07

(See Appendix A 12.)

13. *Harbor at Isles of Shoals, Maine.*—The most protected anchorage at Isles of Shoals, known as Gosport Harbor, lies between Star Island on the south and southwest, Cedar Island on the southeast, and Smuttynose Island on the north and northeast. At mean low water its anchorage of about 32 acres had a depth of 18 to 48 feet and none of its entrances less than 24 feet.

The original project of March 3, 1821, appears to have been to rebuild the small breakwater on the north side of Haleys Cove, projecting westerly from Smuttynose Island to Cedar Island, directly protecting Gosport Harbor from easterly storms.

The amount expended on the original project prior to operations under the existing project was $13,251.61.

The existing project, adopted by the act of June 13, 1902, is to construct a breakwater on the base of the breakwater that was built under the project of 1821 between Smuttynose and Cedar islands, the upper part of which throughout its length had been demolished down to the level of 1½ feet above mean low water, at an estimated cost of $30,000.

The amount expended on the work of the existing project to June 30, 1909, is $28,201.60, all for improvement, with which the breakwater between Smuttynose and Cedar islands has been completed to the height of 15 feet above mean low water, completing the project.

The mean range of tides is 8.6 feet.

The commerce benefited by the improvement is inconsiderable, but the harbor is of value as a harbor of refuge in the open sea 6 miles off the coast.

The tonnage for 1908 is given as 2,208 tons, with an estimated value of about $65,000.

A report of a survey of the Smuttynose Island breakwater is published in the Annual Report of the Chief of Engineers for 1875, Part 2, page 421. A description of the harbor, with survey and estimate for the new breakwater, is given in the Annual Report for 1900, page 1172.

July 1, 1908, balance unexpended	$1,798.40
June 30, 1909, carried to the surplus fund	1,798.40

(See Appendix A 13.)

---

[a] Balance of appropriation of June 6, 1900, amounting to $7,498.85, not considered applicable under existing project.

14. Cocheco River, New Hampshire.—Appropriations amounting to $10,060, made from 1829 to 1837, inclusive, had been applied to the reduction of obstructions in the natural channel prior to the systematic improvement of this river, begun in 1870, when it was found to have a good channel not less than 6 feet deep at mean low water from its confluence with the Piscataqua River to the Lower Narrows, about 1½ miles below the lowest bridge at Dover. Above the Lower Narrows the channel was obstructed by ledges and shoals upon which at mean low water the depth was from 6 inches to 2 feet. The original project for systematic improvement, adopted by the act of March 3, 1871, was to obtain a channel 40 feet wide and 4 feet deep at mean low water from the Lower Narrows to the head of navigation at Dover. Under the original and amended projects completed in 1888 the amount expended prior to operations under the existing project, including the expenditures from 1829 to 1837, was $170;060.

The existing project, adopted by the act of September 19, 1890, is to obtain a channel 60 to 75 feet wide and 7 feet deep at mean low water (in rock 50 feet wide and 7½ feet deep) from the mouth of the river to the head of navigation, at an estimated cost of $175,000. By the act of June 13, 1902, this project was extended to include the restoration of the channel in the Lamprey River, which, from 1881–1883, under specific appropriations, had been dredged at mean high water 100 feet wide and 12 feet deep to the Lower Narrows and 40 feet wide and 11 feet deep to the wharves at Newmarket, N. H.

To June 30, 1909, there has been expended on the existing project for improving Cocheco River, $137,000, as follows: Cocheco River, for improvement, $119,089.93; for maintenance, $9,642.54; for Lamprey River, for maintenance, $8,267.53. As a result the channel in Cocheco River has been completed except over a small portion about 3,500 feet below Dover, where some additional ledge excavation may be necessary, the basin at Dover and the channel near the mouth, where shoaling had occurred, have been redredged, and the channel in Lamprey River has been restored to the full authorized dimensions.

The maximum draft that can be carried in Cocheco River is 6½ feet at mean low tide, and in Lamprey River 11 feet at high tide.

The mean range of tide is 6.8 feet.

The head of navigation is at the lowest bridge in Dover, to which point, 3 miles from its confluence with the Piscataqua River and 13 miles from the sea, the Cocheco River is navigable in fact.

The commerce for 1908 amounted to 169,408 tons, consisting largely of cement, bricks, clay, coal, and lumber, with an estimated value of $813,880. It is reported that the effect of the improvement has been to reduce freight rates and to keep railroad rates down.

The original project, adopted in 1871, is published in the Annual Report of the Chief of Engineers for 1871, page 858; the existing project, adopted in 1890, in the Annual Report for 1890, page 475. A map of Cocheco River in the vicinity of Dover may be found in the Annual Report for 1885, page 474.

July 1, 1908, balance unexpended	$4,711.00
July 1, 1909, balance unexpended	4,711.00

(See Appendix A 14.)

15. Harbor of refuge at Little Harbor, New Hampshire.—In its original condition the entrance to Little Harbor was but 3 feet deep at mean low water, and its anchorage ground, 650 by 125 feet in area and 9 feet in depth at mean low water, was exposed to the full force of the sea.

The original, which is also the existing project, adopted by the act of August 5, 1886, extended by act of August 11, 1888, and as reduced in 1894, is to obtain a channel 3,000 feet long, 100 feet wide, and 12 feet deep at mean low water, and an anchorage basin of the same depth 40 acres in area, and construct two breakwaters at the entrance, at an estimated cost, as revised in 1894, of $145,000.

To June 30, 1909, the amount expended on the existing project is—for improvement, $133,227.33; for maintenance, $3,121.74; total, $136,349.07, with which the project has been completed; but it may be necessary to do some work on the breakwaters from time to time.

The maximum draft over the shoalest part of the improved channel and basin is 11 feet at mean low water. The mean range of tides is 8 feet.

The commerce benefited is inconsiderable, and the improvement is designed to afford a harbor of refuge for yachts and coastwise vessels.

The original project is published in the Annual Report of the Chief of Engineers for 1882, page 507; the modifications, with map of the harbor, in the report for 1887, page 470.

July 1, 1908, balance unexpended	$8,650.93
June 30, 1909, carried to the surplus fund	8,650.93

(See Appendix A 15.)

16. Removing sunken vessels or craft obstructing or endangering navigation.—A contract has been made for removal of the wreck of the schooner *Annie L. Henderson*, which was burned and sunk in about 15 feet of water at mean low tide, in Bangor Harbor, Penobscot River, Maine. The wreck is due to be removed during July, 1909.

The schooner *J. H. G. Perkins* was wrecked and sunk in the entrance to Cape Porpoise Harbor, Maine. It was removed in December, 1908, at a cost of $54.65.

(See Appendix A 16.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination and survey of Camden Harbor, Maine.—Reports dated October 21, 1907, and October 7, 1908, respectively, are printed in House Document No. 1117, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $20,000 is presented.

2. *Preliminary examination and survey of Pepperells Cove, Maine (an arm of Portsmouth Harbor, Maine and New Hampshire), with a view to its deepening and the removal of a ledge.*—Reports dated August 21, 1907, and October 6, 1908, respectively, are printed in House Document No. 1081, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $158,400 is presented.

3. *Preliminary examination and survey of Isles of Shoals, Maine and New Hampshire, with a view to the construction of a breakwater.*—Reports dated September 6, 1907, and September 28, 1908, respectively, are printed in House Document No. 1122, Sixtieth Congress, second session. A plan for building a breakwater between Cedar and Star islands at an estimated cost of $40,000 is presented.

4. *Preliminary examination and survey of Penobscot Bay, Maine, with a view to the establishment of a harbor having a depth of 25 feet, or sufficient to meet the demands of commerce.*—Reports dated October 25, 1907, and November 5, 1908, respectively, are printed in House Document No. 1166, Sixtieth Congress, second session. A plan of improvement at an estimated cost of $38,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE BOSTON, MASSACHUSETTS, DISTRICT.

This district was in the charge of Lieut. Col. Edward Burr, Corps of Engineers, having under his immediate orders First Lieut. Ulysses S. Grant, 3d, Corps of Engineers. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. *Newburyport Harbor, Massachusetts.*—Prior to specific appropriations for Newburyport Harbor funds applicable to Merrimac River, of which it is the estuary, were devoted to removing a sand bar and constructing a breakwater at the river's mouth, 1828 to 1836, and to removing obstructing ledges, piers, and wrecks, 1870 to 1880. In its original condition the outlet of the Merrimac River, which between Plum Island and Salisbury Point was 1,000 feet wide and 30 feet deep at mean low water, was obstructed by a sand bar, nearly a mile outside, through which, in 1880, a narrow channel about 7 feet deep at mean low water was maintained by the current of the river.

The original project adopted by the act of June 14, 1880, which is the existing project, is to create at the outer bar a permanent channel 1,000 feet wide and at least 17 feet deep at mean low water, by constructing two converging jetties, projecting, one from the north shore 2,910 feet, the other from the south shore 1,500 feet, their outer ends 1,000 feet apart, which, with the protection of the beach in their vicinity, was estimated in 1881 to cost $365,000. The direction of jetties and shore protection was modified in 1883, and in 1882 the partial closing of Plum Island Basin with a timber dike about 800 feet long and 5½ feet above mean low water was added to the project, increasing the cost (as estimated in 1884) to $375,000. In 1884 a modification of the project provided for extending both jetties 610 feet parallel to the axis of the channel, and in 1886 for increasing that extension to 1,000 feet, increasing the cost of the work, as estimated in 1897, to $599,547.49.

To June 30, 1909, the amount expended on this project was $396,652.79, of which $9,379.66 was for maintenance. In addition, $500 was expended in 1901 for removal of North rock under authority of act of March 3, 1899. The expenditure for maintenance in the fiscal year 1909 ($1,557.87), was applied to retopping the outer end of the north jetty. By way of refundment, $795.31 was recovered from a failing contractor.

With the expenditure for improvement, the north jetty has been completed for a total length of 2,868 feet and the south jetty completed except for a distance of 30 feet at its outer end; the Plum Island Basin has been closed with a timber dike 817 feet long, 5½ feet high above mean low water, except near the middle, where a weir 150 feet long and 2 feet above mean low water was left temporarily, and two sand catchers, respectively 480 and 572 feet in length, have been built in rear of the south jetty. Both jetties are 15 feet wide on top, which is in a plane 12 feet above mean low water, and have slopes of 1 on 2 on the seaward face and 1 on 1 on the shoreward face. The project is about 80 per cent completed.

June 30, 1909, the maximum draft that can be carried over the bar at mean low water is 12 feet. The mean range of tides is 7.7 feet.

The commerce of the harbor, chiefly coal, amounted in 1907 to 209,896 tons, and in 1908 to 251,239 tons. Of the latter amount 113,840 tons were reshipped to points on the Merrimac and Powow rivers.

It is reported that the improvement made has reduced freight rates 25 cents per ton, and that if the projected depth of 17 feet at mean low water be obtained over the outer bar it would still further reduce the freight rates 15 to 25 cents per ton.

The amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, will be applied to the further extension of the north jetty.

The original project as reported by a Board of Engineers, with map of the harbor, is published in Annual Report of the Chief of Engineers for 1881, page 502; the modifications in jetties and shore protection, in reports for 1883, page 437, and 1884, page 494; the parallel extension of the jetties, with map and additional estimate, in report for 1897, page 825, and a survey of the bar and entrance, in report for 1905, page 802.

A survey and map of the bar and entrance, with estimate for removing obstructions in the mouth of the river, are published in House Document No. 339, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended		$14,781.21
Amount recovered from failing contractor		795.31
		15,576.52
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11,876.13	
For maintenance of improvement	1,557.87	
		13,434.00
July 1, 1909, balance unexpended		2,142.52
Amount (estimated) required for completion of existing project		209,369.28
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.		75,000.00

See Appendix B 1.

2. *Merrimac River, Massachusetts.*—In its original condition the Merrimac River had a practicable channel 7 feet deep at mean low water from its mouth 9 miles to South Amesbury, but besides being narrow and crooked the channel was obstructed by ledges, bowlders, and shoals.

The original projects appear to have been—

(1) For improving the bar at the mouth of the river, by erection of piers or other works, adopted by act of May 23, 1828; subsequently improved under separate project for "Improving harbor at Newburyport, Mass."

(2) For the improvement of the river above the mouth, by the removal of the remains of a dam at the upper falls and of a rock at the lower falls, of Gangway rock in Newburyport Harbor, and a wreck near the mouth of the river.

Upon the original and modified projects, prior to operations under the existing project, there were expended: Upon the project of 1828, $67,466.72, and upon the project of 1870, as largely extended by the acts of June 23, 1874, and June 3, 1896, $187,000; total, $254,466.72.

The existing project, adopted by the act of March 3, 1899, is to obtain a channel 7 feet deep at mean low water, 150 feet wide, from Newburyport 14½ miles to Haverhill, at an estimated cost of $171,442.70.

The amount expended on the existing project to June 30, 1909, is $117,989.48, of which $2,564.71 was applied to maintenance of improvement, and 10 cents derived from sales. With this expenditure the channel has been completed to the full projected depth and width.

The commerce of the river is chiefly in coal distributed to the cities and towns along its banks, and amounted in 1907 to 98,442 tons, and in 1908 to 113,840 tons. The improvement of the channel is reported to enable the delivery of coal by water at rates 35 to 50 cents per ton less than by rail.

The head of navigation is at the hat factory, one-half mile above the railroad bridge at Haverhill, to which point the stream is navigable in fact, 17½ miles above its mouth in Newburyport Harbor.

June 30, 1909, the maximum draft that can be carried at mean low water over the shoalest part of the improved channel is 7 feet, except just below Rocks Bridge, where it is reduced by small bowlders to about 5 feet.

The removal of these bowlders is in progress.

The mean range of tides is, at the mouth of the river, 7.7 feet, and at Haverhill Bridge 4.6 feet, at low-water stage of the river.

The project of 1870–1874 is published in the Annual Report of the Chief of Engineers for 1869, page 421; as extended in 1874, in report for 1876, page 165; as extended in 1896, in report for 1896, page 616; and the existing project adopted in 1899, in report for 1897, page 865.

The report of a survey, with estimate of cost to deepen the channel to 9 feet at mean low water, is published in Annual Report for 1904, pages 872–878.

An examination for a channel 12 feet deep to Haverhill (unfavorably reported), and a survey and estimate for removing obstructions at the mouth of the river (favorably reported), made in 1906, are published in House Document No. 339, Fifty-ninth Congress, second session.

Reports of examination and survey, with map, for a channel 14 feet deep from the mouth of the river to Haverhill, by providing locks and dams, are printed in House Document No. 2, Sixty-first Congress, first session.

The project having been completed, it is proposed to apply the appropriation recommended to the maintenance of the improved channel.

July 1, 1908, balance unexpended	$3,142.58
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	13,142.58
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,131.96
July 1, 1909, balance unexpended	12,010.62
July 1, 1909, outstanding liabilities	760.75
July 1, 1909, balance available	11,249.87
July 1, 1909, amount covered by uncompleted contracts	2,675.92
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix B 2.)

3. *Essex River, Massachusetts.*—In its original condition Essex River had a channel not less than 6 feet deep at mean low water from its mouth in Ipswich Bay for a distance of about 2½ miles; but thence for 2½ miles to the head of navigation in fact at the railroad bridge at Essex, the channel was narrow, crooked, and shallow, having a greatest continuous depth of 1.7 feet, navigation being further impeded by bowlders obstructing the channel.

The original project, adopted July 13, 1892, which is also the existing project, is to obtain a channel 4 feet deep at mean low water and 60 feet wide to the head of navigation, at an estimated cost of $25,000; modified, March 23, 1899, by limiting the improvement to the channel below the bridge at Essex, which had been rebuilt without a draw.

To June 30, 1909, the amount expended was $23,463.93, of which $21,759.21 was for improvement and $1,704.72 for maintenance.

Although the completion of the channel up to the highway bridge at Essex was reported February 2, 1901, complaint was made in 1905 of an obstruction in mid-channel, and in June, 1905, a group of several bowlders, about 1,300 feet below the head of navigation and within the scope of the approved project, was removed at an expense of $300.

For the restoration of the channel $5,000 was appropriated by the act of March 2, 1907, and in accordance with a proviso in the same act the State of Massachusetts has appropriated and paid to the Secretary of War an additional $5,000, and the consolidated appropriation is being applied to the restoration of the channel by the removal of shoals.

The maximum draft that can be carried, June 30, 1909, over the shoalest part of the locality under improvement is reported to be about 2 feet. The mean range of tides is 8.8 feet.

No freight is carried on the river, but the improvement is for the purpose of permitting the exit of about 30 fishing schooners which are built annually on the river, each of about 125 tons register, at an average cost of $12,000.

The project, with map and report of survey, is published in the Annual Report of the Chief of Engineers for 1891, pages 676–678.

The report of a preliminary examination of the river, made in 1905, is printed in House Document No. 68, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended	$7,850.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,313.93
July 1, 1909, balance unexpended	6,536.07
July 1, 1909, outstanding liabilities	125.74
July 1, 1909, balance available	6,410.33
July 1, 1909, amount covered by uncompleted contracts	5,991.74

(See Appendix B 3.)

4. *Harbor of refuge, Sandy Bay, Cape Ann, Massachusetts.*—In its original condition this bay, whose southerly shore extends about 2 miles westerly from the point of Straitsmouth Island, and thence about 2 miles northerly to Andrews Point, had a good holding ground of sand mixed with mud, and a depth of 7½ to 15 fathoms at mean low water, but was fully exposed to easterly, northeasterly, and northerly gales. The original project, adopted by the act of July 5, 1884, was to build a breakwater consisting of a mound of rubblestone to the grade of 22 feet below mean low water, 40 feet wide on top, to be surmounted by a masonry wall, and to extend from Averys ledge a little west of north 3,600 feet to Abners ledge, thence 5,400 feet northwesterly in the direction of Andrews Point, covering an anchorage of about 1,377 acres.

This project, with the cross section of the breakwater as modified by a Board of Engineers February 13, 1900, is the existing project, the breakwater to consist of a mound of rubblestone built to the grade of 12 feet below mean low water, where it will have a width of 117 feet, its harbor slope to be 1 on 1, its seaward slope 1 on 1 up to 25 feet below mean low water, and 1 on 2 thence to the top, 12 feet below mean low water; the rubble mound to be surmounted with a core of rubblestone, to be faced with selected stone to be laid horizontally on the sea face, to weigh not less than 8 tons each and to be laid with a batter of 1 on 2, and on the harbor face to weigh not less than 3 tons each and be laid with a batter of 1 on 1; to be surmounted at grade 17 above mean low water with a single course of capstones, whose upper surface shall be 22 feet above mean low water; at an estimated cost (as revised in 1900) of $6,904,952.25.

The river and harbor act of March 2, 1907, authorized a continuing contract for this work to the extent of $100,000 in excess of the appropriations then made. This sum has since been appropriated.

The amount expended under the existing project to June 30, 1909, not including outstanding liabilities, is $1,587,918.01, all for improvement. From sale of property $1 was derived. With this expenditure 2,052,935 tons of rubblestone has been placed in the substructure of the breakwater, and its condition is approximately as follows:

In the southern arm for a length of 3,530 feet the mound of rubblestone has been completed up to the grade of 12 feet below mean low water, with the full width of 117 feet prescribed in the project; the rubble core of the superstructure has been built to the height of mean low water, 2,990 feet, and to the height of 5 feet above mean low water for 540 feet farther.

In the western arm for a length of 2,500 feet from the angle the mound of rubblestone has been likewise completed to the full height (12 feet below mean low water) and full width (117 feet) projected, except for a small bench on the inner slope 13 feet deep and 17 feet wide; a rubble core of the superstructure has been built to the height of mean low water for 2,100 feet and to the height of mean high water for 400 feet.

The superstructure on the southern arm of the breakwater was commenced in 1908 and at the close of the working season of that year had been completed for a distance of 97 feet, extending in a northerly direction toward the junction with the western arm. Although no storms occurred of unusual severity, an examination made at the close of the winter season disclosed evidences of insufficiency of the superstructure built in accordance with the approved plan, the stone in the lower courses of the wall having been drawn outward. By authority of the Chief of Engineers the construction of a new section 300 feet in length has been undertaken, in which the substructure will be built up to the grade of mean low water where it will have a width of 81 feet, its harbor slope to be 1 on 1, its seaward slope 1 on 1 up to 25 feet below mean low water, and 1 on 2 to the top at mean low water; the rubble mound to be surmounted with a core of rubblestone, to be faced with selected stone to be laid horizontally on the sea face, to weigh not less than 8 tons each and to be laid with a batter of 1 on 1, and on the harbor face to weigh not less than 3 tons each and be laid with the same batter; to be surmounted at grade 17 above mean low water with a single course of capstones, whose upper surface shall be 22 feet above mean low water; the seaward face to be protected with an apron of heavy rubblestone to the height of mean high water, with a slope of 1 on 2.

Of the quantity of rubblestone required in the substructure, 41 per cent has been deposited, which is approximately 31 per cent of the quantity required for both substructure and superstructure.

The depth of water is ample for the largest vessels; the mean range of tides is 8.6 feet.

The appropriation recommended will be applied to extending the superstructure of the breakwater.

The improvement is chiefly of value in providing refuge for coastwise vessels, especially towed barges, which are frequently and suddenly in urgent need of shelter in fog and snowstorms.

For description of Sandy Bay and original project, see Annual Report of the Chief of Engineers for 1884, pages 565-577. For cross section, details of construction, and increase in cost, see report of Board of Engineers, Annual Report for 1900, page 1186.

July 1, 1908, balance unexpended	$213,828.44
Amount appropriated by sundry civil act approved March 4, 1909	75,000.00
	288,828.44
June 30, 1909, amount expended during fiscal year, for works of improvement	126,745.45
July 1, 1909, balance unexpended	162,082.99
July 1, 1909, outstanding liabilities	5,166.76
July 1, 1909, balance available	156,916.23
July 1, 1909, amount covered by uncompleted contracts	131,802.50
Amount (estimated) required for completion of existing project	5,154,952.25
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	500,000.00

(See Appendix B 4.)

5. *Harbor at Gloucester, Mass.*—In its original condition this harbor, which had a depth sufficient for the largest ships, contained several very dangerous submerged rocks and was entirely without protection against the sea and against heavy swells from the south.

The original project, adopted by the act of June 10, 1872, appears to have been for removal of five rocks, at an estimated cost of $10,606.20.

Under the original and modified projects the rocks were removed, Harbor Cove was dredged to the depth of 10 feet at mean low water, and the water front for a distance of 3,900 feet northeast from Fort Point was dredged to a depth of 15 feet at mean low water from the 15-foot contour to the wharf front, upon which there was expended prior to operations under the existing project approximately $86,000.

The existing project adopted by the act of August 18, 1894, provided for the construction of a breakwater from Eastern Point, over Dog bar, to Round Rock shoal at an estimated cost of $752,000; and the act of June 13, 1902, authorized the termination of the breakwater at Cat ledge and the application of any remaining balance "toward the work of removing Round rock," at a reduced estimate of $416,083.43. Under that authority the breakwater was completed in 1905 as far as Cat ledge. Upon a subsequent examination of Round rock shoal it was found that the cost of removing it to the level of the surrounding bottom, exceeding $800,000, was disproportionate to the probable benefits to navigation. The project has been reviewed by the Board of Engineers for Rivers and Harbors, which recommends return to the original project of 1894 for a breakwater from Eastern Point to Round Rock shoal, and its views are concurred in. The total cost of this extension is estimated at $354,000.

The breakwater consists of a mound of rubblestone 31 feet wide at the top at mean low water, surmounted by a superstructure extending 17 feet above the grade of mean low water, formed by two dry walls of heavy split stone, inclosing a core of rubblestone, capped by heavy stones, forming a top course 10 feet in width, the slopes of the rubble structure being on the harbor side 1 on 1.3, on the seaward side 1 on 3 to grade 12 below mean low water, and 1 on 1.5 thence to the bottom.

The amount expended under the existing project to June 30, 1909, not including outstanding liabilities, is $411,979.67 (all for improvement except $200.83 expended in current fiscal year for restoring capstones in maintenance of breakwater), with which 231,756 tons of stone have been put in place, completing, in 1905, to Cat ledge, the breakwater of the projected dimensions.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement is 10 feet in Harbor Cove, 15 feet along the wharf front, and 30 feet in the anchorage under the breakwater.

The mean range of tides is 8.9 feet.

The commerce in 1904 amounted to 263,526 tons, in 1906 to 275,888 tons, and in 1908 to 209,074 tons, of which latter 65,000 tons was coal and 141,000 tons fish and salt. About 80,000 passengers were carried to and from this port by steamer.

A description of the original project is published in the Annual Report of the Chief of Engineers for 1871, page 870, and its modifications, with map, in the report for 1887, page 500.

The adoption and the commencement of work under the existing project are reported upon in the Annual Report of the Chief of Engineers for 1895, page 610.

Reports on examination and survey with map of the harbor, with a view to removal of ledges, will be found in House Document No. 1112, Sixtieth Congress, second session.

July 1, 1908, balance unexpended		$5,843.84
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,539.68	
For maintenance of improvement	200.83	
		1,740.51
July 1, 1909, balance unexpended		4,103.33

(See Appendix B 5.)

6. *Harbor at Beverly, Mass.*—In its original condition this harbor had a practicable channel 18 feet deep at mean low water from Monument bar beacon about 1 mile to its head, about 600 feet below the highway bridge, sufficient for the commerce of the harbor and of its three tributary streams, called, respectively, North River, Essex Branch, and Beverly Creek; but the channel, which is circuitous in its passage through the shoals at the entrance, was found, in 1900, to be "of insufficient width for safe navigation by heavy vessels."

The original project, adopted by the act of June 13, 1902, was to widen the channel from Monument bar beacon to a point about 200 feet east of Rams Horn beacon to a width of 200 feet, with a depth of 18 feet at mean low water, at an estimated cost of $10,000. Upon the original project, prior to operations under the existing project, $8,272.10 was expended, with which the channel was enlarged to the dimensions authorized, except at three points, where the width was restricted by ledges to 106 feet.

The existing project, adopted by the act of March 2, 1907, is to obtain, by dredging and rock excavation, a channel 18 feet deep at mean low water, not less than 250 feet wide at the bend for a distance of about 3,200 feet from Bar beacon to Lobster rocks beacon, including the removal of the middle ground, and not less than 200 feet wide from Lobster rocks beacon to the lower end of the draw pier at the highway bridge, at an estimated cost of $40,000. In addition to $1,727.90 available, $38,500 was appropriated. By way of refundment, $122.24 was received as damages from the surety of a failing contractor under the previous project.

To the close of the fiscal year ending June 30, 1909, $18,972.99 has been expended on this project, all for improvement, with which all the dredging necessary to complete the project has been done. But the channel has a least width of only about 165 feet near bar beacon, and the removal of the remaining ledges at this and three other localities will shortly be accomplished.

The maximum draft that can be carried on June 30, 1909, at mean low water over the shoalest part of the locality under improvement is 18 feet. The mean range of tides is 9 feet.

The commerce of Beverly Harbor consists chiefly of coal and building materials, amounting in 1906 to 138,862 tons, and in 1908 to 223,933 tons, of which 137,000 was coal.

It is expected by those locally interested in shipping that the completion of the project will effect a substantial reduction in freight rates, which to this time have not been appreciably affected by the improvement in progress.

The report of a survey of this harbor is published in the Annual Report of the Chief of Engineers for 1890, page 524. The project of 1902, with report of survey, is in the Annual Report for 1901, page 1065.

The existing project, with report of survey and map, is published in House Document No. 916, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended	$21,432.55
June 30, 1909, amount expended during fiscal year for works of improvement	55.40
July 1, 1909, balance unexpended	21,377.15
July 1, 1909, amount covered by uncompleted contracts	6,669.80

(See Appendix B 6.)

7. Harbor at Lynn, Mass.—An area of shoals extends from the wharves at Lynn 2½ miles southerly to the sea. It is protected from the sea by the peninsula of Lynn Beach and Nahant.

In its original condition three narrow and crooked channels, in which the depth was but 6 feet at mean low water, extended from the wharves to the sea.

The original project, defined in the report of a board of engineers dated April 10, 1884, and as modified in 1888, was to dredge a channel 200 feet wide and 10 feet deep at mean low water from the sea (at White rocks), a distance of 3,300 feet to a deep basin opposite Little Nahant, and from the basin nearly opposite Sand Point, a distance of 6,900 feet to a point 400 feet inside the harbor line, and an anchorage basin 500 feet by 300 feet and 10 feet deep at mean low water; the upper part of the channel to be maintained by occasional dredging, the lower part by a training wall joining the land at Little Nahant, at an estimated cost of $182,000.

The amount expended on this project was $122,063.56, all for improvement, with which the entire channel and the anchorage basin as prescribed in the project were completed.

The existing project, adopted by the river and harbor act of June 13, 1902, is to dredge the channel 200 feet wide from the sea to the anchorage basin and the anchorage basin itself to the depth of 15 feet at mean low water, at an estimated cost of $162,937. Under this project to the close of the fiscal year ending June 30, 1909, $164,373.44 has been expended, all for improvement, with which the projected channel has been completed.

No work was done and none required during the past year in the maintenance of the improvement. The expenditure shown in the money statement was for dredging completed during the preceding fiscal year.

The maximum draft that can be carried June 30, 1909, over the shoalest part of the locality under improvement is 15 feet at mean low water. The mean range of tides is 9.3 feet.

The commerce of the harbor benefited by the improvement consists chiefly of coal, lumber, and building materials, of which about 353,362 tons was carried during the year. The deepening of the channel to 15 feet enables the smaller or medium size barges to carry full cargoes of coal to the wharves at all stages of the tide and barges of the greatest draft during the higher stages.

It is reported by local commercial interests that the cost of transportation was reduced 25 cents a ton by deepening the channel to 10 feet, and further diminished by increasing the depth to 15 feet, but that the full benefit of the improvement will not be realized until the channel and turning basin have been widened as recommended in House Document No. 948, Sixtieth Congress, first session, saving pilotage and towage charges.

The original project approved by the Secretary of War April 21, 1884, is in the Annual Report of the Chief of Engineers for 1884, page 524, and the map of the harbor at page 532.

The existing project was published in the Annual Report of the Chief of Engineers for 1901, page 1093.

Reports on examination and survey for a channel 300 feet wide and basin 500 feet square, both 15 feet deep at mean low water, are printed in House Document No. 948, Sixtieth Congress, first session.

July 1, 1908, balance unexpended	$11,931.72
June 30, 1909, amount expended during fiscal year for works of improvement	6,931.72
July 1, 1909, balance unexpended	5,000.00

(See Appendix B 7.)

8. *Mystic and Malden rivers and Mystic River below the mouth of Island End River, Massachusetts.*—(*a*) *Mystic River.*—In its original condition the Mystic had a practicable channel 6 feet deep at mean low water, extending to Dennings Landing, 3.9 miles above its mouth in Boston Harbor, and 4 feet deep at mean low water about 2,000 feet farther.

The original project for improvement, adopted by the act of July 13, 1892, which is also the present project, is to make the channel 100 feet wide and 6 feet deep at mean low water from the Boston and

Maine Railroad (Western Division) bridge up about 1 mile to the first turn above Denning's wharf; and thence 2 miles to the head of navigation at Medford, 4 feet deep at mean low water, gradually narrowing from 100 feet to 50 feet at the upper end, at an estimated cost of $25,000.

The amount expended to close of the fiscal year, June 30, 1909, is $28,794.88, with which the projected channel was completed in November, 1906.

The maximum draft that can be carried, June 30, 1909, at mean low water is 6 feet up to the first turn above Denning's wharf, and thence to the head of navigation 4 feet. The mean range of tides is 9.8 feet.

The head of navigation is the upper limit of that part of the channel under improvement, at the stone bridge at Medford, to which point, 6 miles above its confluence with the Charles River in Boston Harbor, the stream is navigable in fact.

The commerce benefited by this improvement, chiefly coal, amounted in 1907 to 23,791 tons and in 1908 to 18,229 tons. It is reported that as the smallest barges go out of use the improvement will permit barges of the lightest draft remaining in service to deliver coal at Medford without the expense of lightering, which would be about 50 cents per ton.

A report, with map of the survey of Mystic River and description of the project, is in the Annual Report of the Chief of Engineers for 1891, page 674.

Report of an examination of the river, with a view to its improvement to the upper limits of the city of Somerville, ordered by the act of March 3, 1905, is printed in House Document No. 144, Fifty-ninth Congress, first session.

The appropriation asked for will be applied to maintenance of the improvement.

July 1, 1908, balance unexpended	$8,200.00
July 1, 1909, balance unexpended	8,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Malden River.*—In its original condition the Malden had a practicable channel 4 feet deep at mean low water, extending only 2,000 feet above its confluence with the Mystic.

The original project, adopted by the act of August 2, 1882, was to make the channel 100 feet wide and 12 feet deep at mean high water to the Charles Street Bridge, about 1.8 miles above its confluence with the Mystic, at an estimated cost of $35,000.

The amount expended on the Malden River under the original project and prior to operations under the existing project was $10,000, in obtaining a channel with a least width of 50 feet and 70 feet at turns, with a depth of 12 feet at mean high water from the mouth to the Medford Street Bridge at Malden, a distance of 1¼ miles.

The existing project, adopted by the act of July 13, 1892, is to dredge a channel 12 feet deep at mean high water, 100 feet wide to

---

[a] See consolidated money statement on page 60.

the Medford Street Bridge, 1.6 miles above its confluence with the Mystic, and 75 feet wide about 1,200 feet farther to the Charles Street Bridge, at an estimated cost of $37,000.

The amount expended under the existing project to June 30, 1909, is $51,424.24 (including $36,437.85 for maintenance), with which in 1897 a channel was completed 100 feet wide and 12 feet deep at mean high water up to the Medford Street Bridge. The local officer has reported the river above this bridge to be unworthy of improvement by the United States at this time. The expenditure for maintenance in the fiscal year 1909 was applied to redredging the channel to the full projected depth and width from the Medford Street Bridge for a distance of about 3,600 feet downstream.

The maximum draft that can be carried at mean high water, June 30, 1909, through the improved channel is 12 feet. The mean range of tides is 9.8 feet.

The head of navigation is at the Medford Street Bridge at Malden, to which point the stream is navigable in fact, 1.6 miles above its confluence with the Mystic River.

The commerce amounted in 1907 to 88,575 tons, and in 1908 to 69,422 tons, chiefly coal. The improvement is reported to enable the smallest barges, or larger barges with partial cargoes, to deliver coal at Malden, saving the cost of lightering—50 cents per ton.

A report of the survey of Malden River and description of the original project is on page 532, Annual Report of the Chief of Engineers for 1881.

The modifications of the project are stated in the Annual Report of the Chief of Engineers for 1900, page 1191.

The existing project is described on page 672, Annual Report of the Chief of Engineers for 1891.

The appropriation asked for will be applied to maintenance of the improvement.

July 1, 1908, balance unexpended	$11,210.89
June 30, 1909, amount expended during fiscal year for maintenance of improvement	10,635.13
July 1, 1909, balance unexpended	575.76
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(c) *Mystic River below the mouth of Island End River.*—Island End River is 1¼ miles above the mouth of the Mystic, at the navy-yard in Charlestown, and 2,700 feet above the Chelsea drawbridge over the Mystic.

In its original condition the Mystic up to Island End River had a narrow channel 14.4 feet deep at mean low water, but so narrow above the drawbridge as to be barely practicable.

The original project, adopted by the act of March 3, 1899, which is also the existing project, is to dredge a channel 25 feet deep at mean low water and 300 feet wide, embracing 1.7 miles of the Mystic, extending from its mouth to a point 800 feet above Island End River, at a cost estimated in August, 1899, at $267,547.50 (reduced estimate).

---

[a] See consolidated money statement on page 60

To June 30, 1909, $116,189.89 (all for improvement, except $10,281.92 for maintenance) had been expended in obtaining a channel 25 feet deep at mean low water, with a minimum width of 150 feet off the East Boston wharves, 200 feet wide thence to Chelsea Bridge, and 300 feet from Chelsea Bridge to a point just above the confluence of the Island End River.

With funds appropriated by the act of March 2, 1907, the dredging below Chelsea bridge will be completed in conjunction with the dredging in the same locality for the 35-foot channel of Boston Harbor.

The commerce of the river, which in 1901 amounted to 1,430,650 tons, had increased to 3,715,805 tons in 1908, a gain of 160 per cent in seven years. About three-fourths of all the freight carried on the river is coal.

The maximum draft that can be carried June 30, 1909, over the shoalest part of the locality under improvement is at mean low water 25 feet. The mean range of tides is 9.6 feet

Reports of examination and survey made in 1908, with map, for a channel 30 feet deep at mean low water from the mouth of Island End River to Chelsea Bridge, are printed in House Document No. 1086, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$19,815.23
July 1, 1909, balance unexpended	19,815.23
July 1, 1909, amount covered by uncompleted contracts	17,847.36
Amount (estimated) required for completion of existing project	141,824.30

CONSOLIDATED.

July 1, 1908, balance unexpended	$39,226.12
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	10,635.13
July 1, 1909, balance unexpended	28,590.99
July 1, 1909, amount covered by uncompleted contracts	17,847.36
Amount (estimated) required for completion of existing project	141,824.30
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]20,000.00

(See Appendix B 8.)

9. Harbor at Boston, Mass.—In its original condition the headlands and islands were without protection against the sea, which was extensively eroding them. Dangerous rocks obstructed the approach and entrance from Nantasket Roads to the lower main ship channel through the Narrows. That channel was 23 feet deep at mean low water, with a least width of 150 feet. The upper main ship channel from President Roads to Boston had a least depth of 18 feet at mean low water, with a least width of 100 feet. The channel from President Roads to Broad Sound in the ocean had a least depth of 29 feet at mean low water, with a least width of 200 feet.

---

[a] For Mystic and Malden rivers only, no estimate being submitted for Mystic River below mouth of Island End River.

The original project, adopted by the act of March 2, 1825, was "for the preservation of the islands in Boston Harbor, necessary to the security of that place," and until 1866 all expenditures, amounting to $546,526.10, appear to have been applied to that purpose in the building and repair of sea walls. The amount expended upon them since 1866 can not be accurately stated.

The project for the improvement of the harbor adopted by the act of March 2, 1867, was (as modified) to make the main ship channel from Nantasket Roads to Boston 23 feet deep at mean low water, 600 feet wide through the Narrows to President Roads, and 1,000 feet wide from President Roads to Boston.

To this project of improvement were added, from time to time, minor channels within or tributary to the harbor, since completed with allotments from the appropriation for Boston Harbor, known as Nantasket Beach channel, Nix Mate channel, Jeffries Point channel, Chelsea Creek, Charles River, and Fort Point channel.

Under the original project for sea walls and supplemental project for the channels above named there has been expended for improvement and maintenance to June 30, 1909, $2,612,747.31, exclusive of all expenditures upon the five existing projects (three for the main channels and two for tributary channels), with which expenditure 3.75 miles of sea walls were built, protecting the most exposed headlands and islands, the subordinate channels described in the preceding paragraph (except Charles River) were completed, and a channel obtained 23 feet deep at mean low water from Nantasket Roads to Boston, with a least width of 625 feet in the Narrows and 850 feet between President Roads and the city. From sales of property $124.95 has been derived.

The expenditure for general improvement during past year was for engineering expenses in connection with contract for dredging in Fort Point channel.

The amount requested for general improvement will be applied to necessary repairs to sea walls and maintenance of improvements heretofore made in the tributary channels of the harbor.

The existing projects for improvement of the main channels are—

1. Adopted by the river and harbor act of July 13, 1892: To widen the main ship channel, from Nantasket Roads to Boston, to 1,000 feet, and to deepen it to 27 feet at mean low water, at an estimated cost of $1,250,000, subsequently increased to $1,488,751. Project completed.

2. Adopted by the river and harbor act of March 3, 1899: To widen the Broad Sound channel to 1,200 feet, and to deepen it to 30 feet at mean low water, at an estimated cost of $455,000. Project completed.

3. Adopted by the river and harbor act of June 13, 1902: To provide channels 35 feet deep at mean low water, 1,200 feet wide from the navy-yard at Charlestown and the Chelsea Bridge and Charles River Bridge to President Roads, and 1,500 feet wide from President Roads through Broad Sound to the ocean, at an estimated cost of $7,994,000 in round numbers. This estimate differs from any made in the project quoted in the act as the basis of the appropriation, owing to the different width of the channels adopted. (To avoid a large amount of rock excavation the 35-foot channel from President Roads to Broad Sound is in a different location from the 30-foot channel.)

Under the project of July 13, 1892, to June 30, 1909, the amount expended was $1,472,606.29, of which $58,215.30 was for maintenance, and $10 derived from sales. With the total amount expended under this project the upper and lower main ship channels from Boston to President Roads and from President Roads to the sea have been dredged to the width of 1,000 feet and depth of 27 feet at mean low water. In the upper main ship channel the full width and depth are available. In the lower main ship channel the available width of the 27-foot channel is contracted by shoals to 650 feet. The maximum draft that can be carried at mean low water, June 30, 1909, over the shoalest part of the locality under improvement is 27 feet. A map of the project is in the Annual Report of the Chief of Engineers for 1894, page 554.

Under the project of March 3, 1899, to June 30, 1909, the amount expended was $385,200, all for improvement, with which a channel 1,200 feet wide and 30 feet deep at mean low water was dredged from President Roads to Broad Sound, embracing the dredging of 965,383.9 cubic yards of sand, gravel, and clay and 198.864 cubic yards of bowlders, and the removal of 156 cubic yards of ledge. The maximum draft that can be carried at mean low water, June 30, 1909, over the shoalest part of the locality under improvement is 30 feet. The project is published in Annual Report of the Chief of Engineers for 1898, page 886.

Under the project of June 13, 1902, continuing contracts to the amount of $3,600,000 were authorized by the act of that date, and pursuant thereto a channel of the full projected depth, but 540 feet wide, from the navy-yard, Charles River Bridge, and Chelsea Bridge to President Roads, and 675 feet wide from President Roads through Broad Sound to the ocean, was begun in 1903 and is now nearing completion. By the act of March 2, 1907, Congress authorized the completion of the 35-foot channel to the full projected widths, appropriating $500,000 for the purpose and authorizing contracts to the amount of $3,894,000 additional, of which $2,694,000 remains to be appropriated. Under this authorization a single contract for all the dredging required to complete the channel has been let and work was begun on October 28, 1907. Contracts for rock excavation will be let from time to time as ledge may be uncovered by the dredging.

To June 30, 1909, the amount expended, not including outstanding liabilities, was $3,861,860.91 ($58.59 was derived from sales), all for improvement. The work accomplished to the end of the fiscal year in the upper main ship channel was the dredging of 10,677,441 cubic yards of mud, sand, gravel, and clay; 18.642 cubic yards of bowlders; and the excavation of 28,725 cubic yards of ledge (excluding 3,025 cubic yards of ledge nearly removed, but which work has not been accepted for payment); and in Broad Sound channel the dredging of 2,790,619 cubic yards of mud, sand, gravel, clay, hardpan, and cobblestones, and 88.248 cubic yards of bowlders. The total amount of material dredged is 13,468,060 cubic yards, and of rock excavated is 28,725 cubic yards, or about 60 per cent in volume of all the dredging, and 25 per cent of all the rock excavation, required under the project. The yardage expressed refers to scow measurement except for rock excavation, which is *situ* measurement. The dredging necessary to obtain the channels of partial width described in the preceding paragraph and begun in 1903 is about 96 per cent completed, and the removal of the ledge from this partial width is about 98 per cent completed. No continuous channel with the depth of 35 feet at mean low water has yet been obtained.

The appropriation recommended will be applied to dredging and rock excavation under continuing contracts.

A map of the project is published in the Annual Report of the Chief of Engineers for 1903, page 768.

The mean range of tides is 9.5 feet at Boston light and 9.6 feet in the upper harbor.

The foreign exports and imports for the port of Boston during the calendar year ending December 31, 1908, amounted in value to $173,475,517, being an increase of $106,788,996 over the valuation in 1867, when the systematic improvement of the channels was begun.

As to the effect of the improvement on freight rates, the general manager of the principal foreign steamship lines entering this port states that about thirty years ago steamers were employed with a loaded draft of 20 feet to 24 feet; twenty-two or twenty-three years ago, of 25 to 26 feet; fourteen years ago, 27 or 28 feet; ten years ago, 28 feet 9 inches; later, 31 feet, and recently one of 33 feet 10½ inches. He states, generally—

> that freight rates, caused by the larger class of steamers being used, are about 50 per cent less than they were some fifteen or twenty years ago, when very much smaller steamers were engaged in the trade.

Tributary channels.—(*a*) *Charles River.*—In the original condition of the 9 miles of natural channel of this river, from its mouth to the dam at the head of navigation at Watertown, the depth at mean low water, from the mouth 4¾ miles to the Western Avenue Bridge, was not less than 7 feet, except in several places, covering about 1¼ miles, below Brookline Bridge, where the depth varied from 4½ to 7 feet. From Western Avenue Bridge 2½ miles to the Arsenal Street Bridge the depth was 4 feet. Thence 1¾ miles to the dam it varied between 0 and 9½ feet.

The original project, adopted by the act of June 14, 1880, which is also the existing project, is to widen and deepen the natural channel so that at mean low water it shall be from its mouth to Western Avenue Bridge 200 feet wide and not less than 7 feet deep; thence to Market Street Bridge 80 feet wide and 6 feet deep; thence to the dam 60 feet wide and 2 feet deep; at an estimated cost of $125,000.

The amount expended to June 30, 1909, is $57,500, all for improvement, with which the channel has been completed as prescribed in the project up to the Arsenal Street Bridge (now called also Western Avenue Bridge). The project has been 40 per cent completed.

The head of navigation is at the dam at Watertown, the upper limit of that part of the channel under improvement, to which point, 9 miles above its confluence with Mystic River in Boston, the stream is navigable in fact.

The improvement made by the United States lies wholly above the West Boston (Cambridge) drawless bridge, completed in 1907, which precludes the passage of all masted vessels. The tidal basin has now been converted by the State of Massachusetts into a fresh-water lake with dam and lock; almost the entire river front has been acquired for park purposes; and on the section of the river under improvement all but three commercial wharves have been extinguished. The depths in the sections of channel improved by the United States, above and below Western Avenue Bridge, are 13.4 feet and 14.4 feet, respectively, at the permanent level in the basin above the dam. Whenever required by the Secretary of War the State of Massachusetts will increase these depths 2.2 feet, as far as Brackett's wharf, in compensation for the decrease in depth at high water resulting from the establishment of this permanent basin level. The commerce benefited by the improvement consisted in 1907 of 83,335 tons, and in 1908 of 90,213 tons all coal, the improvement enabling the delivery at wharves on the river without breaking cargoes at Boston, saving the cost of one handling and the greater cost of transportation from Boston by rail.

The district officer is of opinion that so much of the existing project as provides for a channel from Brackett's wharf to Market Street Bridge, a distance of about 1,300 feet, and from Market Street Bridge to the dam at Watertown, is unworthy of prosecution by the General Government. This opinion is concurred in. The river and harbor act of September 19, 1890, appropriated $20,000 for continuing improvement of Charles River—

> *Provided*, That no expenditure of said twenty thousand dollars shall be made until the draws in the Arsenal Street and Market Street bridges shall be made to conform to the projected channel without cost to the United States.

The Arsenal Street Bridge has been altered to conform to the projected channel, and as the Market Street Bridge is above the limits to which it is now believed that the channel should be extended, it was recommended that Congress authorize the expenditure of the $20,000 appropriated in 1890 in obtaining a channel of the projected width and depth to Brackett's wharf and in maintaining the Charles River improvement. These funds, however, were carried to the surplus fund pursuant to section 10 of the sundry civil act approved March 4, 1909, and no further work in connection with the improvement of the river is contemplated until additional action is had by Congress through the appropriation of the necessary funds, or otherwise.

The improvement of Charles River by the State of Massachusetts has been carried on under authority of permits issued to the Charles River Basin Commission by the Secretary of War under dates of May 18, 1904, and October 5, 1904. These permits authorized the construction of the dam at the site of old Craigie Bridge and of the necessary appurtenances thereto for maintaining at a level not less than 7.4 feet above mean low water the pool to be formed upstream from the dam. In connection with the dam the State was required to construct a lock with a clear width of 45 feet and a length of 350 feet between gates, the lower sill of the lock being 17 feet below mean low water and the upper sill being 13.6 feet below mean low water, or 21 + feet below pool level. It is also required that the Charles River Basin Commission, or its successor, shall operate the lock at its own expense as a free public waterway of the United States. The permits above mentioned also require that the commission shall maintain in the Charles River from the head of the 35-foot channel at Charles River Bridge to the dam and lock such depth and width of channel as may be necessary for the commerce of the river and as may be specified by the Secretary of War; that it shall dredge and maintain in the basin, from the head of the lock to the channel in the river, a channel 100 feet wide and 18 feet deep at mean low water, in a location to be approved by the Secretary of War; and that the commission shall, whenever called upon to do so by the Secretary of War, deepen by 2.2 feet the channel 80 feet wide called for by the present approved project for the improvement of the Charles River by the United States, known as the project of June 14, 1880, the said deepening to extend as far as Brackett's wharf. Under the authority contained in these permits the Charles River Basin Commission has completed the lock and has carried forward the work on the dam to such a point that the river is closed thereby and is maintained at the designed pool level. The other work necessary to comply with the terms of the two permits is not completed at the present time or is awaiting the exercise of the discretion vested in the Secretary of War.

A full description of the project, together with map of the river, showing the progress of the improvement to this date is on page 512, Annual Report of the Chief of Engineers for 1884.

(*b*) *Fort Point channel.*—In its original condition the mid-channel depth was 12 feet at its mouth and 16 feet thence to the Federal Street Bridge, excepting at the draw in the Congress Street Bridge, where it was 14.5 feet at mean low water.

The original project, adopted by the act of August 5, 1886, which is also the existing project, is to dredge a channel 175 feet wide and 23 feet deep at mean low water from the entrance about 4,190 feet to near Federal Street Bridge, at an estimated cost of $100,000, reduced in 1887 to $78,750.

The total cost to the United States was $70,541.33 (including $9,219.10 for maintenance), with which the improvement was completed in November, 1907. In the execution of this work there were dredged, in 1897, 94,211 cubic yards, and, in 1907, 157,940 cubic yards; total, 252,151 cubic yards.

The removal of the Mount Washington Avenue Bridge across the channel, pursuant to the order of the War Department, necessitates the dredging of its site to the authorized channel dimensions, which work is in progress at the date of this report.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part of the improved channel is 23 feet. The mean range of tides is 9.6 feet.

The head of navigation is the southern extremity of South Bay, at Massachusetts avenue, Boston, Mass., to which point, about 2 miles from the entrance to the channel in Boston Harbor, the channel is navigable in fact.

The commerce benefited by this improvement consists of coal, sugar, building materials, and miscellaneous merchandise, which amounted in the calendar year 1906 to 1,416,671 tons, in 1907 to 1,443,686 tons, and in 1908 to 1,251,390 tons.

For a description of the project see Annual Report of the Chief of Engineers for 1888, page 452.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended		$75,079.23
Receipts from sale		2.70
		75,081.93
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$14.33	
Carried to surplus fund	20,000.00	
		20,014.33
July 1, 1909, balance unexpended		55,067.60
July 1, 1909, outstanding libailities		4,720.15
July 1, 1909, balance available		50,347.45
July 1, 1909, amount covered by uncompleted contracts		534.26
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a]75,000.00

PROJECT OF 1892 FOR 27-FOOT CHANNEL.

July 1, 1908, balance unexpended	$33,000.00
July 1, 1909, balance unexpended	33,000.00

PROJECT OF 1899 FOR 30-FOOT CHANNEL THROUGH BROAD SOUND.

July 1, 1908, balance unexpended	$69,800.00
July 1, 1909, balance unexpended	69,800.00

PROJECT OF 1902 FOR 35-FOOT CHANNEL.

July 1, 1908, balance unexpended	$1,382,771.02
Amount appropriated by sundry civil act approved March 4, 1909	1,200,000.00
Receipts from sales	2.70
	2,582,773.72
June 30, 1909, amount expended during fiscal year, for works of improvement	1,144,576.04
July 1, 1909, balance unexpended	1,438,197.68
July 1, 1909, outstanding liabilities	427,601.37
July 1, 1909, balance available	1,010,596.31
July 1, 1909, amount covered by uncompleted contracts	2,299,747.44
Amount (estimated) required for completion of existing project	2,694,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	1,200,000.00

(See Appendix B 9.)

---

[a] At the time this estimate was prepared and submitted to the Secretary of War it was expected that certain balances of appropriations for improvement of Boston Harbor would necessarily be covered into the surplus fund of the Treasury under the requirements of section 10 of the sundry civil act approved March 4, 1909. These balances having been retained under authority of joint resolution approved June 25, 1909, this estimate may now be reduced to $25,000 without detriment to the work involved.

10. Dorchester Bay and Neponset River, Massachusetts.—Dorchester Bay is at the mouth of Neponset River, in Boston Harbor. The present controlling depth at mean low water in the bay up to Commercial Point, at the mouth of the river, is 13 feet; thence up the river to the highway bridge at Neponset, 1½ miles above its mouth, it is 8 feet, and from said bridge up to Milton Mills, 4 miles above its mouth and at the head of navigation, it is 3½ feet.

The original project, which is also the existing project, adopted by the act of March 2, 1907, is to obtain by dredging a channel 175 feet wide and 18 feet deep at mean low water through Dorchester Bay and the mouth of the river to Commercial Point; and 100 feet wide and 15 feet deep at mean low water in Neponset River from Commercial Point to the Neponset highway bridge; estimated to cost $125,233.34.

The act of March 2, 1907, appropriated the full amount of the estimate, with the proviso:

> That no part of this sum shall be expended until the Secretary of War shall have received satisfactory assurance that the improvement of that portion of the Neponset River described in said House document [No. 83, 59th Cong., 2d sess.] which lies above the project herein adopted shall be made and hereafter maintained by the State of Massachusetts or other agency without expense to the Government of the United States.

The improvement contemplated under this proviso is to secure a channel 6 feet deep from Neponset highway bridge to Milton Mills, 100 feet wide between the said bridge and the Granite bridge, 75 feet wide thence to Godfrey's wharf, and thence 50 feet wide for a farther distance of 250 feet.

The legislature of Massachusetts by the following resolves, approved by the governor June 24, 1907, and March 5, 1908, respectively, has given assurance satisfactory to the Secretary of War that the improvement of the river above Neponset bridge will be made and hereafter maintained by the State of Massachusetts:

> That there be allowed and paid out of the treasury of the Commonwealth a sum not exceeding thirty-four thousand two hundred and seventy dollars and forty-four cents to be expended under the direction of the harbor and land commissioners in the improvement of that part of the Neponset River which lies above the Neponset highway bridge: *Provided, however,* That no part of said amount shall be so expended until the United States shall have completed the improvement of Dorchester Bay and the Neponset River to a point at the aforesaid Neponset highway bridge.
>
> * * * * * * *
>
> That the conditions set forth in the act of Congress known as the river and harbor act approved March second, nineteen hundred and seven, which require that no part of the sum appropriated by Congress by said act shall be expended until the Secretary of War shall have received satisfactory assurance that the improvement of a certain part of the Neponset River above the improvement provided for by the said act of Congress shall hereafter be maintained by the Commonwealth of Massachusetts or other agency, without expense to the Government of the United States, are hereby accepted, and the said conditions shall be observed by the Commonwealth in accordance with the terms of the act of Congress aforesaid.

The amount expended on this project to June 30, 1909, is $45,159.80, all for improvement, with which the 15-foot section of channel between Commercial Point and the Neponset highway bridge has been dredged to the authorized dimensions; and work upon the 18-foot section has been begun. The amount of material dredged during the past fiscal year was 301,306 cubic yards. The mean range of tides is 9.6 feet.

During the calendar year 1907 the total commerce of the bay and river was 349,764 tons, and in 1908 337,397 tons, of which 70,218 tons was carried to Milton above the limits of the improvement undertaken by the United States.

The purpose of the improvement is to permit the delivery at the localities concerned of freight, principally coal at the lowest freight rates, by providing a depth of water necessary to accommodate ocean-going barges.

The head of navigation is at Milton Mills, to which point 4 miles above the mouth of the river the stream is navigable in fact.

The project for the improvement of the bay and river, with report and map of survey, is published in House Document No. 83, Fifty-ninth Congress, second session. The report of an examination of this river made in 1892 is printed in the Annual Report of the Chief of Engineers for 1893, page 800; and the report of an examination and survey in 1897, in the Annual Report for 1897, page 876.

July 1, 1908, balance unexpended	$125,192.52
June 30, 1909, amount expended during fiscal year, for works of improvement	45,119.32
July 1, 1909, balance unexpended	80,073.20
July 1, 1909, outstanding liabilities	11,737.54
July 1, 1909, balance available	68,335.66
July 1, 1909, amount covered by uncompleted contracts	36,572.68

(See Appendix B 10.)

11. *Weymouth River, Massachusetts.*—(*a*) *Weymouth Fore River.*—In its original condition the channel had a depth of 18 feet at mean low water with a least width of 300 feet up to a point about 1 mile below Weymouth Fore River bridge, at Quincy Point, the 18-foot channel extending 3,400 feet above that point, but too tortuous for safe navigation of large vessels. In the remaining 1,800 feet to the bridge the channel, when surveyed, was 150 feet wide and 13 feet deep at mean low water, but, before the adoption of the project, had been increased without expense to the United States to the width of 200 feet and depth of 15 feet at mean low water. Above the bridge the channel was 12 feet deep at mean low water for a distance of 2,200 feet, 6 feet deep with a practicable width a distance of 4,000 feet farther, and 3 feet deep a distance of 7,000 feet farther; but the channel was too narrow to be practicable.

The original project, adopted by the act of September 19, 1890, was to obtain in Weymouth Fore River for a distance of 7,000 feet below the head of navigation a channel with the uniform depth of 6 feet at mean low water with the width of 100 feet to near Weymouth Landing, 80 feet thence to Braintree Bridge, and 50 feet thence 950 feet above that bridge, at an estimated cost of $40,000. The amount expended under that project was $42,750 (including $2,750 for maintenance), with which, except for four small ledges uncovered by dredging, there was dredged and maintained to 1906 a channel of the full projected dimensions, the future maintenance of which devolves upon the State of Massachusetts under acts of Congress and the legislature of Massachusetts, printed on pages 824 and 825 of the Annual Report of the Chief of Engineers for 1905.

The existing project, adopted by the act of March 3, 1905, embraces only that portion of the river extending from its mouth in Hingham Bay about 3½ miles up to Weymouth Fore River bridge at Quincy Point, and is to dredge a channel about 1 mile long, 300 feet wide, and 18 feet deep up to that bridge, at an estimated cost of $57,500.

The amount expended on this project is $55,000, all for improvement, with which the authorized channel has been completed.

The expenditure for the fiscal year given in the money statement was for dredging completed during the preceding year.

The maximum draft that can be carried through the portion of the river embraced in this improvement is 18 feet at mean low water. The mean range of tides is 9.5 feet.

The head of navigation is 2.7 miles above this improvement at East Braintree, to which latter point the navigable length of Weymouth River from its mouth is 6.2 miles.

The freight carried on the river amounted in 1904 to 95,843 tons, and in 1908 to 173,649 tons, of which more than 87 per cent was coal. The increased depth obtained is of importance chiefly to the Fore River Ship Building Company, which builds at its extensive plant at Quincy Point large passenger and freight steamers, cruisers, and battle ships up to 20,000 tons. This company states that while no direct reduction in freight rates has been realized, the improved channel has proven of greater value and benefit in permitting the entrance of larger barges loaded with coal and lumber and the passage of vessels of greater draft between the harbor and the shipyards on the river.

The original project of improvement (above Weymouth Fore River bridge) is printed in the Annual Report of the Chief of Engineers for 1890, page 522. A report of the survey of the river (below Weymouth Fore River bridge) is printed in the Annual Report of the Chief of Engineers for 1904, pages 891–898.

July 1, 1908, balance unexpended	$4,465.80
June 30, 1909, amount expended during fiscal year for works of improvement	1,965.80
July 1, 1909, balance unexpended	2,500.00

(*b*) *Weymouth Back River.*—In its original condition Weymouth Back River had a practicable channel not less than 200 feet wide and not less than 12 feet deep at mean low water from its confluence with Weymouth Fore River, 8,000 feet to the wharf of the American Agricultural Chemical Company, except on its bar, 400 feet across, one-fourth of a mile above its mouth, where the depth was 11 feet, and except the 2,000 feet next below that wharf, where the depth gradually shoaled from 12 feet to 6 feet at mean low water.

The original project, adopted by a proviso in the act of August 18, 1894, which is also the existing project, is to dredge in Weymouth Back River a channel, 12 feet deep at mean low water, 200 feet wide through the bar, and to extend the channel, 12 feet deep at mean low water and 200 feet wide, 2,200 feet, to the wharf of the American Agricultural Chemical Company, at an estimated cost of $22,000.

The amount expended on this project is $22,000 (including $1,521.32 for maintenance), with which the channel has been dredged to the dimensions authorized by the project. After the completion of the improvement, by the application of the remaining funds in maintenance during the fiscal year 1908 the full depth of channel previously dredged was restored with the width of 175 feet through the bar near the mouth of the river and 180 feet thence to the head of the improvement. The present deficiency in width is due to deterioration of the portion of the channel dredged in 1897, and the amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied to restoring the full width of the improved channel.

The maximum draft that can be carried at mean low water over the shoalest part of the locality under improvement is 12 feet. The mean range of tides is 9.4 feet.

The head of navigation is about 4 miles above the bar at the mouth of the river, and about 3 miles above the wharf of the Chemical Company, which is the upper limit of the improvement.

The commerce benefited by the improvement comprised, in 1907, 169,756 tons, and in 1908 170,064 tons, of which about seven-eighths was raw and manufactured fertilizer products.

A report of the survey of Weymouth Back River is printed in the Annual Report of the Chief of Engineers for 1891, page 683.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	$5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CONSOLIDATED.

July 1, 1908, balance unexpended	$4,465.80
June 30, 1909, amount expended during fiscal year for works of improvement	1,965.80
July 1, 1909, balance unexpended	2,500.00

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a] 5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix B 11.)

12. Hingham Harbor, Massachusetts.—In its original condition the channel leading to Hingham, south of Ragged and Sailor islands, was very narrow and crooked and obstructed by sunken rocks and shoals, over which the least depth was 4 feet at mean low water, while the available width of channel was but 30 feet.

The original project, adopted by the act of March 3, 1875, was to widen and deepen the natural channel by dredging and blasting to the width of 100 feet and depth of 8 feet at mean low water from deep water near the head of the harbor to the steamboat wharf, a distance of about 2,500 feet, at an estimated cost of $11,000. This improvement was completed in 1884, with the expenditure of $9,316.58, all for improvement, allotted from the appropriation for improving harbor at Boston, Mass.

The existing project, adopted by the act of August 5, 1886, and completed in 1893, is to deepen the improved channel 100 feet wide to 10 feet at mean low water and remove a mid-channel ledge, in the lower channel between Chandlers and Ragged islands, at an estimated cost of $18,750. By the act of March 2, 1907, without previous estimate, $10,000 was appropriated for redredging the channel, and by the river and harbor act of March 3, 1909, the unexpended balance of this appropriation was "made available for redredging and improving the channel."

---

[a] For Weymouth Back River.

In accordance with the desire of local commercial interests, active steps toward the application of this appropriation have been suspended awaiting action by Congress to make the funds available for extension instead of maintenance and improvement of channel heretofore improved.

To June 30, 1909, $19,327.72 (including $327.72 for maintenance) has been expended under the existing project.

The maximum draft that can be carried June 30, 1909, over the shoalest part of the locality under improvement is 8½ feet at mean low water. The mean range of tides is 9.5 feet.

The commerce benefited by the improvement consists of coal and building materials, of which 12,370 tons was received during the calendar year 1908, slightly less than the freight reported received in 1883; but the line of Boston passenger steamers which at the time the improvement was made landed at the pier at the head of the improved channel has long since been discontinued.

The original project, with survey of the harbor, is in the Annual Report, Chief of Engineers, for 1875, Part 2, page 417. A report of the survey upon which the present project is based is in the Annual Report for 1885, page 555, and a map of the harbor in the report for 1888, page 456.

July 1, 1908, balance unexpended	$9,672.28
July 1, 1909, balance unexpended	9,672.28

(See Appendix B 12.)

13. Harbors of Plymouth and Provincetown, Mass.—(a) *Harbor at Plymouth.*—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1909, is $73,437.28, with which 11,843 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected as damages from the surety of a failing contractor.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the appropriation recommended to maintenance of improvement.

The commerce consists chiefly of coal and lumber, of which 33,354 tons was received in 1906 and 39,860 in 1908.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1909, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet.

The town of Plymouth at its own expense has undertaken to restore and deepen to 10 feet at mean low water the channel and basin completed by the Government.

The mean range of tides is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. The project of 1899 is printed in the report for that year, page 1089. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

Reports of examination and survey, with a view to the construction of a rubblestone breakwater from Long Beach along the crest of Browns Island, are printed, with map, in House Document No. 1168, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$8,270.94
July 1, 1909, balance unexpended	8,270.94
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(*b*) *Harbor at Provincetown, Mass.*—This is an important harbor of refuge in the bight at the extremity of Cape Cod.

In its original condition the width and depth of its entrance and the depth of its anchorage were ample for the largest vessels, but actual or threatened inroads by the sea across the low and narrow part of the cape east of the town, and at intervals along about 1½ miles of the narrow beach southwest of the town, were a serious menace to the harbor.

The original project, adopted by the act of May 20, 1826, was "for the preservation of the point of land forming Provincetown Harbor."

The project from 1826 continuously to this date has been, by building dikes and groins and by other sand-catching devices, to arrest the erosion and promote the accretion of the barrier of beach and sand dunes which protects and preserves the harbor.

Work during the past year consisted in extending southerly the bulkhead at Abel Hill dike a distance of 48 feet; minor repairs to the bulkhead were also made.

The amount expended to June 30, 1909, is $215,395.99, all applied to improvement.

The preservation of the harbor, whose importance as a harbor of refuge requires no elaboration, depends upon the maintenance of the barrier from Abel Hill to Long Point as a protection against westerly and southwesterly seas. Since the commencement of the improvement it has been sought to maintain this barrier by means of timber structures of temporary character, designed to catch and hold the sand moved by the sea and wind. Although in the vicinity of and below Wood End they have been partially successful in accumulating sand moved by the wind, for the greater part of the distance between Abel Hill and Wood End they have failed in the long run to accomplish their purpose, and now for a considerable part of this distance there exists between the ocean and the harbor only a light, sand-filled, wooden bulkhead, built on the beach whose crest is below the level of spring tides. The failure of these works may be attributed to absence of any great quantity of wind-driven sand, and to the inability of light timber structures to withstand the inroads of the sea. As a result of storms of recent winters, a portion of the beach is now in such a condition that temporary expedients can not be relied upon or expected to hold it through another winter of average westerly storms. For the security of the harbor a rubblestone dike is required across House Point Island flats from the vicinity of Stevens Point to a point northeasterly from Wood End Light, as shown in a general way on the map at page 576 of the Annual Report of the Chief of Engineers for 1886, estimated to cost $135,000, and to this purpose the appropriation asked for will be applied. It is recommended that provision for the entire work be made at one time, either by a single appropriation or by the continuing-contract system.

The maximum draft that can be carried to the anchorage is ample for the largest vessels.

The balance available will be applied to works of protection for preserving and strengthening the beach that preserves the harbor.

A description and plan of works are in the Annual Reports of the Chief of Engineers for 1876, 1879, 1886, and 1897, pages 181, 273, 574, and 878, respectively.

The commerce of this port is a small factor in this improvement compared with the preservation of this very excellent and important harbor of refuge.

July 1, 1908, balance unexpended	$7,167.13
June 30, 1909, amount expended during fiscal year, for works of improvement	400.15
July 1, 1909, balance unexpended	6,766.98
July 1, 1909, outstanding liabilities	5.43
July 1, 1909, balance available	6,761.55
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	135,000.00

CONSOLIDATED

July 1, 1908, balance unexpended	$15,438.07
June 30, 1909, amount expended during fiscal year, for works of improvement	400.15
July 1, 1909, balance unexpended	15,037.92
July 1, 1909, outstanding liabilities	5.43
July 1, 1909, balance available	15,032.49
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	145,000.00

(See Appendix B 13.)

14. Channel between North and South Hero islands, Lake Champlain, Vermont.—By the original project, adopted by the act of July 4, 1836, this channel, sometimes called "The Gut," was deepened by dredging to 8 feet at mean low water. The work was completed in 1839, at a total expense of $21,000.

In 1881 it was found by survey that the channel, about 1½ miles long, had an average depth of 10½ feet, with sufficient width, except that it was obstructed at its western entrance by a bar through which the channel was 40 feet wide and 7 feet deep, and at its eastern entrance by a bar through which the channel was 100 feet wide and 8 feet deep.

The existing project, adopted by the act of August 11, 1888, is to obtain a channel 150 feet wide and 10 feet deep at both entrances, at an estimated cost of $14,300. The dredging was done in 1889 and the channel reported as completed.

Since 1897 it has been reported that the western entrance to the passage was obstructed by a dangerous bowlder in mid-channel and that the channel was 1 to 4 feet shoal and 25 feet narrower than the project prescribed. A survey of the channel made in January, 1906, in connection with the complaint that the bridge of the Rutland Railroad Company is an unreasonable obstruction to navigation through the channel, shows that the channel has shoaled to the depth of approximately 7 feet at low lake level. Under an order of the Secretary of War requiring that company to restore and maintain the authorized channel dimensions, in lieu of altering its bridge, the restoration of the channel was accomplished in 1908.

To June 30, 1909, the amount expended under the existing project is $10,000, appropriated by the act of 1888.

This channel is the main water connection between the commercial channel on the western side and Swanton Harbor and St. Albans Bay on the eastern side of the lake, and is generally used by steam and sailing vessels plying in that part of the lake, but the amount of commerce benefited by the improvement can not be accurately stated. Two steamers, carrying freight and considerable numbers of passengers, each pass through this channel twice daily during the season of navigation.

The existing project with report of survey, is published in the Annual Report of the Chief of Engineers for 1897, page 3299.

Report upon the examination of this channel, with a view to its further improvement, will be found, with map, in House Document No. 1109, Sixtieth Congress, second session.

15. Harbor at Burlington, Vt.—Before improvement there was ample depth of water along the docks and wharves, but they were without protection against wind and seas from Lake Champlain. In the greatest exposure during the prevalent northwesterly gales the wind has a sweep obliquely across the lake of about 10 nautical miles.

The original project, adopted by the act of July 4, 1836, was to build a breakwater parallel with the shore and about 1,000 feet from the docks and wharves.

Under the original and modified projects the amount expended for construction prior to the adoption of the project of 1886 was $501,811.07, with which 3,551 feet of breakwater was built.

The existing project, adopted in 1886, is to extend the breakwater 1,500 feet (500 feet northerly and 1,000 feet southerly), at an estimated cost of $150,000; enlarged in 1894 and 1902 to embrace repairs and replacing the crib superstructure (4,157 feet) with one of stone or concrete, at a cost estimated at $173,750, a total of $323,750.

In the execution of this work it developed that through deterioration of the timber cribs, the substructure on the lake face of the breakwater for a distance of 1,165 feet is in a serious condition as to stability. A rubble mound extending the full height of the substructure cribs, estimated to cost $52,000, should be built without delay to support and protect the lake face of the substructure.

Under the existing project there was expended to June 30, 1909, $238,261.34, of which $59,738.69 was applied to extending the breakwater 606 feet (364 feet northerly and 242 feet southerly), making the total length of the structure 4,157 feet. The remainder, $178,522.65, was applied to repairs and completing the rebuilding of 3,240 feet of superstructure, including $34,555 expended in repairing portions of the substructure thereunder, the necessity for which repairs could not be foreseen until the old superstructure was removed. From sales there was derived $146. The extension is 40 per cent and the rebuilding of the superstructure 78 per cent completed.

During the year 327 linear feet of concrete superstructure of the breakwater were built and repairs made to 124 linear feet of the foundation of the superstructure thereof.

The extreme variation of level of water surface is 6½ feet and the usual variation about 4 or 5 feet.

Of the appropriation asked for, $52,000 will be applied to the construction of a rubble protection for the substructure of a portion of the breakwater, and $34,555 to rebuilding the superstructure in accordance with the project of 1902. This latter sum was expended for repairs to the substructure or foundation, which had to be made prior to the erection thereon of said superstructure, and was defrayed from funds designed for continuing the rebuilding of the superstructure.

The commerce amounted in 1904 to 107,421 tons, and in 1908 to 249,174 tons, of which, in 1908, nearly 80 per cent was lumber.

A description of the existing project for repairs and maintenance may be found in the Annual Report of the Chief of Engineers for 1901, page 1072, and a description and history of the work in the Annual Report for 1897, page 3296.

July 1, 1908, balance unexpended	$32,993.90
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	27,754.24
July 1, 1909, balance unexpended	5,239.66
Amount (estimated) required for completion of existing project	[a]124,555.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[b] 86,555.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix B 14.)

16. Narrows of Lake Champlain, New York and Vermont.—In its original condition the 15 miles of this waterway extending from the northern terminus of the Champlain Canal, at Whitehall, northerly to Benson Landing, Vt., had a narrow and tortuous channel not more than 9½ feet to 10 feet deep on the shoals at low water.

The original project, adopted by the act of August 5, 1886, was to obtain, by dredging and by a small amount of rock excavation, a channel with a least width of 150 feet and depth of 12 feet at low water from Whitehall to deep water below Benson Landing, a distance of 15 miles. On the original project (as extended in 1890 to widen and straighten the middle reaches of the channel) the amount expended prior to operations under existing project was $63,500.

The existing project, adopted by the act of March 3, 1899, is to widen the channel and restore it to the depth of 12 feet at mean low

---

[a] Amount (estimated) required for completion of existing project:

Improvement—Extension of breakwater 900 feet (project of 1886), balance	$90,000
Maintenance (project of 1902)—Expenditures for repairs to substructure or foundation prior to rebuilding the superstructure	34,555
	124,555

[b] Appropriation recommended for maintenance of improvement:

Repairs to substructure already made (see preceding note)	34,555
Rubblestone protection for substructure	52,000
	86,555

water in five localities; also to provide fenders for protecting barges from collision with the rocky banks of the channel at Puts rock, the Narrows, and Pulpit Point, at an estimated cost of $22,500.

To June 30, 1909, the amount expended under the existing project was $24,615, including $615 for maintenance, with which the project has been completed. The only work carried on during the fiscal year consisted of surveying the channel to determine the location and extent of shoaling which was reported to have taken place. Available funds will be applied to maintenance of the improvement.

To June 30, 1909, the maximum draft that can be carried over the shoalest part of the locality under improvement is 12 feet at low water. The extreme variation of level of water surface is 6½ feet, and the usual variation about 4 or 5 feet.

From the foot of the canal at Whitehall to the head of Lake Champlain at Crown Point the navigable length of the Narrows is 37 miles. From Whitehall navigation is continued to the Hudson River and Erie Canal by the Champlain Canal, which is 65 miles long, from the southern extremity of the Narrows at Whitehall to Troy, N. Y.

The commerce consists principally of coal, pulp wood, building material, and general merchandise, and amounted in 1907 to 724,529 tons, and in 1908 to 565,414 tons.

The original project, with report and map of the survey of the channel, is published in the Annual Report of the Chief of Engineers for 1885, pages 2312 and 2315, and the existing project in the Annual Report for 1897, page 3302, and 1898, page 1046.

July 1, 1908, balance unexpended	$4,985.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	600.00
July 1, 1909, balance unexpended	4,385.00

(See Appendix B 15.)

17. *Removing sunken vessels or craft obstructing or endangering navigation.*—(*a*) *Wreck of steamer City of Birmingham, in Boston Harbor, Massachusetts.*—This steamer was sunk in Boston Harbor on November 4, 1907, on the southerly side of the 27-foot channel and about 1,800 feet northwesterly from Castle Island. The removal of the wreck was completed November 19, 1908, under formal contract, at a cost of $13,200.

(*b*) *Wrecks in Narrows of Lake Champlain, New York.*—Wrecks of 18 canal boats and 2 steamers were found to be dangerous obstructions to navigation. Contract for their removal has been let, and work is in progress at the date of this report.

(See Appendix B 16.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents, as indicated:

1. *Preliminary examination and survey of Mystic River, Massachusetts, with a view to the construction of a channel 30 feet deep from the mouth of Island End River to Chelsea bridge.*—Reports dated June 19, 1907, and May 2, 1908, respectively, are printed in House Document No. 1086, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $172,000 is presented.

2. *Preliminary examination of Lake Champlain, Vermont, to improve navigation in connection with the breakwater at Burlington, the channel known as "The Gut" between Tromps Point, South Hero Island, and Bow Arrow Point, and the harbor of St. Albans, and survey of the harbor of St. Albans.*—Reports dated November 25, 1907, and July 28, 1908, respectively, are printed in House Document No. 1109, Sixtieth Congress, second session. The first two localities (breakwater at Burlington and dredging at "The Gut") were not considered worthy of further improvement by the United States; for the third locality (harbor of St. Albans) a plan of improvement at an estimated cost of $5,000 is presented.

3. *Preliminary examination and survey of Gloucester Harbor, Massachusetts, with a view to removing ledges.*—Reports dated October 24, 1907, and October 31, 1908, respectively, are printed in House Document No. 1112, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $51,000 is presented.

4. *Preliminary examination and survey of Plymouth Harbor, Massachusetts, with a view to the construction of a rubblestone breakwater, extending from Long Beach easterly along the crest of Browns Island.*—Reports dated November 20, 1907, and September 8, 1908, respectively, are printed in House Document No. 1168, Sixtieth Congress, second session. The locality is not considered worthy of improvement by the United States at the present time.

5. *Preliminary examination and survey of Merrimac River, Massachusetts, with a view to providing by locks and dams a channel 14 feet deep from the mouth of the river to the railroad bridge at Haverhill.*—Reports dated November 30, 1907, and November 30, 1908, respectively, are printed in House Document No. 2, Sixty-first Congress, first session. The locality is not considered worthy of improvement in the manner contemplated by the act.

IMPROVEMENT OF RIVERS AND HARBORS IN THE NEWPORT, RHODE ISLAND DISTRICT.

This district was in the temporary charge of Maj. Harry Taylor, Corps of Engineers, to October 6, 1908, and in the charge of Lieut. Col. James C. Sanford, Corps of Engineers, since that date. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. *Harbors at Hyannis and Nantucket, Mass.*—These works were consolidated by the river and harbor act of 1902.

(*a*) *Harbor of Refuge at Hyannis, Mass.*—The harbor of Hyannis lies on the south shore of the peninsula of Cape Cod and about 15 miles to the westward of the heel of the cape, and is an important harbor of refuge.

This harbor before improvement was an open roadstead, exposed to southerly storms. About 8 feet at mean low water could be carried to the wharf of the New York, New Haven and Hartford Railroad Company.

In the years 1827–1838 a breakwater 1,170 feet long was constructed of riprap granite, covering an anchorage of about 175 acres, the entrance to which has a depth of about 15.5 feet.

Between the years 1852 and 1882 extensive repairs were made, increasing the width of the base of the breakwater and the size of the stone forming its sides and top.

The sum of $123,431.82 had been expended at this harbor prior to operations under existing project.

The project of 1884 provided for dredging to 15.5 feet at low water about 36 acres area north of the existing breakwater, so as to increase the deep-water anchorage by that amount, all at a total estimated cost at that time of $45,743.20, increased $30,568.94 in accordance with the report of December 2, 1899, by the river and harbor act of June 13, 1902, making the total estimated cost $76,312.14.

At the adoption of this project the 15.5-foot depth anchorage covered only about 47 acres, and the 36 additional acres to be dredged carried a depth of from 7 to 15.5 feet of water at low water.

The total amount expended at this locality to June 30, 1909, was $197,298.79, none of which was applied to maintenance. The 1884 project had been completed and two cuts, each 25 feet wide and 13 feet deep at mean low water, had been dredged in the channel leading to the wharf of the New York, New Haven and Hartford Railroad Company.

The mean rise and fall of the tide is about 3 feet.

The principal value of this harbor to commerce is as a harbor of refuge for coasters and fishing vessels. The actual commerce of the place is, in general, lumber and other building materials, coal, and fish, aggregating in the last calendar year 21,100 tons, valued at $219,600.

A survey will be made to determine whether deterioration has taken place and work of restoration is necessary.

For reference to former reports in which more extended information may be found, see Annual Report of the Chief of Engineers for 1905, page 75.

Amount received from bondsmen of failing contractor	$500.00
June 30, 1909, amount expended during fiscal year, for works of improvement	11.04
July 1, 1909, balance unexpended	488.96

(*b*) *Harbor of refuge at Nantucket, Mass.*—This harbor is the only one between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of 100 miles, except the small harbor of Hyannis, on the north side of Nantucket Sound. It has a considerable area, with a depth of water in excess of 12 feet, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod. Incidentally it forms a commercial harbor for the island of Nantucket, and it is the only one on the island. So far as known it has never been used to any extent as a harbor of refuge.

In its original condition the channel entrance was obstructed by a bar 1.5 miles in width, on which there was only 6 feet of water at mean low tide, the channel being very crooked and subject to changes in location. Between 1829 and 1844 an ineffectual attempt was made to dredge a channel through the bar; $45,734.75 was expended prior to beginning operations under the existing project.

The present project, adopted in 1880 and modified in 1885, provides for the construction of two jetties, one on each side of the entrance, and for dredging when necessary in order to obtain a channel depth of from 12 to 15 feet at low water. Estimated cost, $375,000, exclusive of cost of dredging.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, exclusive of outstanding liabilities, was $387,823.48, of which $7,210 was expended in repairs to the west jetty, $6,312.90 to the east jetty, and $50,000 in dredging.

About 79 per cent of the whole project has been completed. No works of improvement or maintenance have been in progress during the fiscal year. The expenditures were for survey, care of property, and collection of commercial statistics.

About 83 per cent in length of the west jetty and 90 per cent of the east jetty have been constructed. A channel 200 feet wide and 12 feet deep at mean low water was dredged between the jetties during the working season of 1905.

The mean rise and fall of the tide is about 3 feet. During an unusually severe storm in December, 1896, a breach was made through the Haulover Beach between the ocean and the head of the harbor. The breach remained open until the spring of 1909, when it closed from natural causes.

A survey of the jetty channel made in June, 1909, shows that considerable scour has taken place throughout most of the dredged channel, but that a bar about 400 feet wide has formed just outside of the end of the east jetty over which there is a minimum depth of 10.7 feet, which is now the greatest depth that can be carried into the harbor at mean low tide.

A large portion of the 3,955 feet of the west jetty, built prior to 1884, has been damaged somewhat by storms and ice and, having no core of small stone, allows considerable sand to pass through it. This should be repaired so as to be as sand tight as possible and raised to its original height. It is estimated that $30,000 will be required to complete the repairs in addition to the estimated cost of the project.

The approved project for this work contemplates building two converging jetties and the excavation by dredging of so much of the channel as may not be deepened by the tidal scour. The estimate of the cost of the approved project was $375,000 for the jetties alone. But the height above low water was left to be determined by experience, and it will be some years before the work can be considered as complete. Owing to the exposed situation, the character of the bottom, and the effect of ice, $13,522.90 of the appropriation for construction is properly chargeable to maintenance, for which no special allotment was made. Dredging, which was included in the project but not in the estimate, had been postponed year by year to observe the action of the jetties, but $50,000 for the purpose of dredging was first applied from the appropriation of March 3, 1905. The dredged channel, now about 200 feet wide and 12 feet deep at mean low water, should be increased in width from the deep water off Brandt Point in the inner harbor to the deep water outside the jetty entrance, and the estimate for completion includes $50,000 for that purpose, making a total increase in the estimated cost of $100,000 on account of dredging.

Further work under the project will consist in raising the incomplete portions of both jetties as may be required, and deepening and widening the dredged channel, with a view to the extension and maintenance of the benefits to be derived from the improvement. It is proposed to apply the amount estimated as a profitable expenditure to deepening and widening the channel by dredging and to enlarging and strengthening such portions of the jetties as may be necessary.

The entire commerce of Nantucket is carried on at this harbor, amounting in 1908 to about 26,840 tons, valued at $1,000,600, consisting largely of general merchandise, lumber, coal, forage, grain, and live stock.

The effect of this work will be to afford a place of refuge easy of access and free from storms for coasters and fishing vessels.

For reference to reports containing more detailed information, see Annual Report of the Chief of Engineers for 1905, page 76.

July 1, 1908. balance unexpended		$2,024.31
Amount allotted from appropriation by river and harbor act approved March 3, 1909		20,000.00
		22,024.31
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$354.29	
For maintenance of improvement	166.75	
		521.04
July 1, 1909, balance unexpended		21,503.27
July 1, 1909, outstanding liabilities		60.02
July 1, 1909, balance available		21,443.25
Amount (estimated) required for completion of existing project		101,312.90
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		80,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended		$2,024.31
Amount allotted from appropriation by river and harbor act approved March 3, 1909		20,000.00
Amount received from bondsmen of failing contractor		500.00
		22,524.31
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$365.33	
For maintenance of improvement	166.75	
		532.08
July 1, 1909, balance unexpended		21,992.23
July 1, 1909, outstanding liabilities		60.02
July 1, 1909, balance available		21,932.21
Amount (estimated) required for completion of existing project		[a] 101,312.90
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a] 80,000.00

(See Appendix C 1.)

---

[a] For harbor of refuge at Nantucket, Mass.

2. *Harbor at Vineyard Haven, Massachusetts.*—Vineyard Haven is a deep indentation on the northern shore of Marthas Vineyard Island, on the southern side of Vineyard Sound.

The headlands on either side of the entrance to the harbor were gradually wearing away and the adjacent parts of the harbor were shoaling. The mean range of tide is 1.7 feet.

The existing project of 1888, as modified in 1889, provides for the protection of the "Chops" (or headlands) from erosion and the intervening harbor from being filled with the eroded material, the whole to be done by means of stone sea walls and jetties built along the beach in front of the bluffs at both headlands. The total cost was estimated in 1889 at $60,000, the whole of which has been appropriated.

The sum of $55,387.35 had been expended on this work up to June 30, 1909, by which there had been built a series of riprap jetties and sea wall, which appear to have afforded the needed protection.

No works of improvement were in progress during the past fiscal year.

This harbor, being at present the most accessible refuge for the immense fleet of coasting vessels plying between points north and south of Cape Cod, is more extensively used than any other on the southern coast of New England.

For reference to former reports giving more extended information, see Annual Report of the Chief of Engineers for 1905, page 77.

Further work at this harbor will depend upon the action taken by Congress upon the report of the Board of Engineers provided for in the river and harbor act of June 13, 1902, and printed at page 949 of the Annual Report of the Chief of Engineers for 1904. Such further work would be for the extension of benefits.

The commerce for 1908 was about 16,820 tons, valued at $916,610, consisting chiefly of coal, general merchandise, grain, forage, fish, and lumber.

July 1, 1908, balance unexpended	$4,612.65
June 30, 1909, covered into surplus fund, United States Treasury	4,612.65

(See Appendix C 2.)

3. *Woods Hole channel, Massachusetts.*—Woods Hole channel is a waterway or strait connecting Buzzards Bay and Vineyard Sound through the so-called "Great Harbor," lying near the southwestern part of Cape Cod, Massachusetts. Little Harbor lies to the east of Great Harbor and is separated from it by Parkers Neck.

Before improvement in the strait the channels were crooked and obstructed by bowlders, and the velocity of the currents at certain stages of the tide was from 5 to 7 miles per hour. The site of the wharves and basins of the United States Fish Commission and Revenue-Marine Service was a submerged point of land from the shore of Great Harbor.

The original project of 1879 provided for making a channel through the bar at the entrance to Little Harbor and widening and deepening the channel through the strait. The project of 1883, extended in 1884 and 1886, provided for the construction of retaining walls on shore, a stone pier, and a wooden wharf, mainly for the use of the United States Fish Commission and incidentally for the use of other branches of the public service, all of which work had been completed prior to 1889.

The amount expended on the original and modified projects prior to beginning operations on the existing project was $113,599.92, by which the entrance to Little Harbor had been dredged to 10 feet depth and a direct channel 9 feet deep had been dredged through the strait. The retaining walls, stone pier, and wooden wharves at the United States Fish Commission had also been built and repaired.

The existing project, that of June 3, 1896, provides for deepening the channel through the strait to 13 feet at mean low water and widening the same to 300 feet, with a branch channel of same dimensions leading from the strait toward the wharves; estimated cost, $396,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, exclusive of outstanding liabilities, was $163,321.53, resulting in the practical completion of the project. The work done during the fiscal year consisted in blasting away a small point of rock near the easterly end of the main channel which could not be removed by dredging. It is believed that a clear passage of 13 feet depth at mean low tide now exists through the strait by both channels; but a further survey is needed, which will be made as soon as possible, and any other shoals found will be removed.

The mean rise and fall of the tide is about 4 feet at the Buzzards Bay end of the channel and 1.65 feet at the Vineyard Sound end.

The improvement has resulted in greatly lessening the danger to vessels passing through the straits and in rendering it possible for larger vessels to pass through, thereby saving about 10 miles in distance if bound from the east to New Bedford and about 19 miles if bound for Wareham.

The prices at which contracts have been let for this work have been much less than the original estimates, and the relative proportion of the large bowlders to the smaller and lighter material less than the estimated amount based on previous work, so that the project will be completed for much less than the amount originally estimated.

The commerce of Woods Hole in 1908 was about 61,200 tons, mostly coal and fish, valued at $838,000.

No account was kept of vessels passing through the strait and not stopping at Woods Hole.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 79.

July 1, 1908, balance unexpended	$80, 179. 89
June 30, 1909, amount expended during fiscal year, for works of improvement	13, 501. 42
July 1, 1909, balance unexpended	66, 678. 47
July 1, 1909, outstanding liabilities	594. 51
July 1, 1909, balance available	66, 083. 96

(See Appendix C 3.)

4. Harbors of New Bedford and Fairhaven, Mass.—New Bedford Harbor is an estuary of Buzzards Bay, at the mouth of the Acushnet River, the Fairhaven side of the harbor being called "Fairhaven Harbor."

Before improvement the channel had a depth of 12.5 feet at mean low water. The improvement of this harbor has been carried on under a number of distinct projects, the first being the removal of a wreck and dredging the sand bar formed by it in 1836–1839, on which $10,000 was expended. The projects of 1874 and 1877 provided for a channel 300 feet wide and 15 feet deep at mean low water from the deep water just above Palmers Island to the wharves of New Bedford. This work was completed in 1877 at a cost of $20,000.

This was followed after 1887 by various projects in which the controlling depth was 18 feet at mean low water and comprised channels 200 feet wide from Buzzards Bay to New Bedford, about 150 feet wide along the city wharf front above and below the New Bedford and Fairhaven bridge, an anchorage area about one-half mile long and 600 feet wide on the northerly side of the main channel between New Bedford and Fairhaven, and a channel 250 feet wide leading from the anchorage area through the draw in the bridge to the wharves above, with a turning basin above the bridge. The total cost of the 18-foot projects, which were completed in 1906, was $137,709, making a total of $167,709 expended prior to the adoption of the existing project.

The existing project was adopted by the river and harbor act of March 2, 1907, and provides for dredging channels 25 feet deep at mean low water, 300 feet wide from Buzzards Bay to the north end of Fish Island, just above the New Bedford and Fairhaven bridge, with a turning basin above the bridge, and an anchorage area of about 114 acres, 25 feet deep, between New Bedford and Fairhaven, at an estimated cost of $527,000. An appropriation of $100,000 was made and contracts authorized in the additional sum of $200,000, which has since been appropriated for prosecuting the work. Section 3 of the river and harbor act approved March 3, 1909, contained the following provision modifying the project of 1907:

> Improving harbors of New Bedford and Fairhaven, Massachusetts: The authorization for the improvement of said harbors contained in the river and harbor act of March second, nineteen hundred and seven, is hereby extended so as to include the extension of the basin north of Fish Island, now being dredged under the adopted project, southward between the harbor lines to the bridge between New Bedford and Fish Island, and the extension of the twenty-five foot channel along the New Bedford front from its terminus, as contemplated by the present project, northerly between established harbor lines to said bridge: *Provided*, That a contract or contracts for such improvement can be made within the limit of cost authorized by the said act of March second, nineteen hundred and seven.

At the adoption of the existing project 18 feet depth of water was available for vessels to reach the wharves of New Bedford, but the channel was too narrow, the anchorage small, and the depth insufficient to accommodate the commercial demands of the port.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $273,850.33, exclusive of outstanding liabilities, by which the work of dredging under a continuing contract was continued throughout the fiscal year. The turning basin and channel above the drawbridge and the channel leading from the anchorage area to the drawbridge for a width of about 200 feet have been practically completed; a considerable portion of the anchorage area has been deepened to 25 feet, and a channel 135 feet in width has been dredged from Buzzards Bay to the anchorage area, but both the dredged portion of the anchorage area and the latter channel contain shoals still to be removed.

About 23½ feet of water at mean low tide can now be carried from Buzzards Bay through the harbor to the drawbridge, about 3 miles, and to the harbor line below the bridge. Through the bridge about 18 feet can be carried, and 25 feet from the bridge through the turning basin, about 0.2 mile. A farther distance of about 2 miles up the Acushnet River is navigable, with a natural depth of from 6 to 15 feet of water.

The mean range of tide is about 4.2 feet.

It is proposed to apply the amount estimated as a profitable expenditure to the widening and deepening of the channel and enlarging the anchorage area by dredging to the full projected dimensions. The additional work proposed is in part necessary to make the improvement available and also for the extension of benefits.

The commerce of the harbor in 1908 amounted to about 1,511,885 tons, consisting mostly of coal, building materials, general merchandise, and cotton, valued at $41,091,124.

The effect of the deep water on commerce is the use of deeper draft vessels than formerly, larger cargoes, and a consequent reduction in water freight charges.

For reference to reports containing more detailed information, see Annual Report of the Chief of Engineers for 1905, page 81.

The report of the survey of New Bedford and Fairhaven harbors, dated May 18, 1906, upon which the existing project is based, is printed as House Document No. 271, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$209,789.05
June 30, 1909, amount expended during fiscal year, for works of improvement	183,639.38
July 1, 1909, balance unexpended	26,149.67
July 1, 1909, outstanding liabilities	18,978.62
July 1, 1909, balance available	7,171.05
July 1, 1909, amount covered by uncompleted contracts	3,621.83
Amount (estimated) required for completion of existing project	227,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	227,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix C 4.)

5. *Sakonnet Harbor, Rhode Island.*—Sakonnet Point is a rocky headland on the eastern side of the mouth of Sakonnet River, and lies about 6 miles east of Newport. This point in connection with Churchs Cove forms an anchorage known as Sakonnet Harbor. Before improvement this harbor was protected from storms from the northeast, south, and southeast by the mainland, but was exposed to westerly storms. In 1827 a project was prepared for a breakwater 400 feet long at this point, and about 200 feet of this was built at that time. The project of 1899 provided for prolonging the old breakwater out to a rock nearly north of it and raising the whole to

a height of 8 feet above mean low water. This project was completed in 1900 at a cost of $25,000.

The existing project, adopted by the act of March 2, 1907, provides for the removal of a rock from the harbor to the depth of 8 feet at mean low water at an estimated cost of $10,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $9,002.50, exclusive of outstanding liabilities, by which the removal of the rock was completed.

No further work is contemplated.

For more detailed information, see Annual Reports of the Chief of Engineers for 1889, page 649; 1895, page 749; 1897, page 935; 1901, page 1126, and for the report on preliminary examination and survey upon which the existing project is based, page 1148 of the same report for 1901.

The commerce of this harbor in 1908 amounted to about 4,974 tons, consisting largely of coal and other fuel, general merchandise, grain, and forage, valued at $380,016.

July 1, 1908, balance unexpended	$9,983.49
June 30, 1909, amount expended during fiscal year, for works of improvement	8,985.99
July 1, 1909, balance unexpended	997.50

(See Appendix C 5.)

6. *Taunton River, Massachusetts.*—This river rises in Norfolk County, Mass., and empties into Mount Hope Bay at Fall River.

In its original condition the channel was narrow and obstructed by bowlders and from Berkley Bridge to Taunton the depth was in places not more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton. From 1870 to 1879 $63,000 was appropriated and expended to secure 9 feet depth at high water. This work was completed in 1879.

The existing project, adopted June 14, 1880, provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water, with 100 feet width from its mouth up to Berkley Bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs shoal; thence 11 feet depth with 80 feet width up to the "shipyard;" thence with 11 feet depth with 60 feet width up to Weir Bridge, Taunton; all at a total cost estimated in 1893 at $125,000, all of which has been appropriated.

The amount expended on the existing project up to June 30, 1909, exclusive of outstanding liabilities, was $134,316.36, by which all projected work had been practically completed and the shoals offering the greatest obstruction to the navigation of the river had been redredged several times. About $28,316.36 of the above amount has been expended in the maintenance of the channel. Vessels of 11 feet draft can reach Taunton at high water, but at some points the 11-foot channel is very narrow. It is estimated that $5,000 every four years will be required to maintain the channel.

The head of navigation is about 1 mile above Weir Bridge, 14 miles above Fall River. No portion of the river above Weir Bridge has been improved.

The mean range of the tide is about 5½ feet at Dighton and 3.4 feet at Taunton.

The expenditures during the fiscal year were for the removal of a shoal opposite the stove-lining works at the lower end of Weir village, and a few obstructing bowlders at points farther down the river.

It is proposed to apply the amount estimated as a profitable expenditure to dredging in such portions of the river as may shoal by freshets or otherwise.

The tonnage of 1908 was about 74,323 tons, mostly coal and other fuel and minerals, valued at $359,008.

Further work on this river will be for the maintenance of benefits secured by the improvement.

For reference to reports giving more extended information, see Annual Report of the Chief of Engineers for 1905, page 82.

July 1, 1908, balance unexpended	$4,989.45
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	9,989.45
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,305.81
July 1, 1909, balance unexpended	5,683.64
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix C 6.)

7. *Sakonnet River, Rhode Island.*—Sakonnet River is an arm of the sea between the island of Rhode Island and the mainland, extending from the ocean to Mount Hope Bay, around the head of Rhode Island. Before improvement it was obstructed near its upper end by a causeway, known as the "Stone Bridge," extending across it. This causeway had two openings, one covered by a draw, but both the draw opening and the passage through it were of insufficient width, and the waterway of insufficient depth for the needs of commerce, in addition to which the causeway offered such obstruction to the ebb and flow of the tides that the currents through the openings made the passage dangerous even to boats of such dimensions as could pass through them under ordinary circumstances.

The existing project, adopted June 3, 1896, provides for increasing the width and depth of the channel through the draw opening in the proposed new Stone Bridge, to be built by the State of Rhode Island, so as to secure a channel through the opening 100 feet in width and 25 feet deep at mean low water, estimated to cost $40,000.

Due to delay in securing necessary legislative action by the State of Rhode Island with reference to rebuilding Stone Bridge, no work had been done and no funds expended prior to May, 1905, when preliminary steps were taken for the widening and deepening of the channel. The work was completed October 3, 1905.

The amount expended on the existing project up to June 30, 1909, exclusive of outstanding liabilities, was $38,426.95, by which the work of enlarging the channel was completed.

While the passage of this point is greatly improved by the increased depth and width, the velocity of the current has not been materially reduced. The new drawbridge, which is of the bascule type, is now completed.

No further work is contemplated under the approved project.

July 1, 1908, balance unexpended	$1,573.05
June 30, 1909, amount covered into surplus fund, United States Treasury..	1,573.05

(See Appendix C 7.)

8. *Pawtucket (Seekonk) River, Rhode Island.*—This river is the upper portion of the Providence River, the navigable portion extending from Pawtucket to Providence, a distance of 4 miles. Before improvement the channel in the river was narrow and had a ruling depth of about 5 feet at mean low water. Between 1867 and 1873 $52,000 was appropriated to dredge the channel to 7 feet depth. This work was finished in 1876. The project of July 5, 1884, provided for deepening the river so as to secure a channel of at least 12 feet depth at low water with 100 feet width from its mouth, at Providence, up to Grant & Co.'s wharf at Pawtucket, and thence 12 feet depth with 40 feet width, through a ledge rock for a short distance farther, to Division Street Bridge, the head of navigation, all at a total cost estimated in 1883 at $382,500, of which $284,000 has been appropriated.

The river and harbor act of March 3, 1899, modified this project so as to provide for straightening that portion of the channel between Tenmile River and Bucklins Island. The project, with its modification, has been completed, with an expenditure of $282,444.91. The total expenditures prior to the adoption of the existing project were $334,444.91.

The existing project, adopted by the river and harbor act of March 3, 1905, provides for deepening the channel to 16 feet at mean low water with 100 feet width and a channel through the ledge rock at Pawtucket of 16 feet depth at mean low water and 50 feet wide, at an estimated cost of $237,875.

The appropriation of $35,000 made by the act of 1905 was applied to excavating a channel through about 200 feet in length of ledge rock.

The river and harbor act of March 2, 1907, contains the following item:

> Improving Pawtucket River, Rhode Island: Completing improvement, one hundred and thirty-five thousand five hundred and eighty-four dollars: *Provided,* That no part of this sum shall be expended unless the further amount of sixty-seven thousand seven hundred and ninety-two dollars shall be provided by the State of Rhode Island or other agency, and made subject to the order of the Secretary of War in such manner as he may direct, to be expended under his direction upon said project for its completion.

The general assembly of the State of Rhode Island passed an act making this appropriation, but—

> *Provided,* That requisition for one-half of said sum shall be made on or after the first day of July, A. D. 1908, and requisition for the remainder of said sum shall be made on or after the first day of July, A. D. 1909, by said Secretary of War.

In accordance with the provisions of the act of March 2, 1907, separate contracts were entered into for all of the rock excavation and dredging required for the completion of the project.

Section 3 of the river and harbor act of March 3, 1909, modified this project as follows:

> Pawtucket River, Rhode Island: Any balance remaining unexpended after the completion of the work provided for under the existing contracts for improving the Pawtucket River, Rhode Island, may be used in deepening the channel of the river to eighteen feet, and in increasing the widths thereof at such places between Pawtucket and Providence as may best subserve the interests of commerce: *Provided*, That the work herein authorized shall not be undertaken until the consent of the State of Rhode Island shall have been given for the application to this purpose of the portion of said balance heretofore contributed and pledged by the said State.

In accordance with this act the general assembly passed the following resolution on April 2, 1909:

> Whereas the Congress of the United States has by law enacted that the appropriations or authorizations for appropriations heretofore made with reference to the Pawtucket River, Rhode Island, may, in the discretion of the Secretary of War, and upon the recommendation of the Chief of Engineers, be diverted or applied upon modified projects for said Pawtucket River, as follows, viz: Any balance remaining unexpended after the completion of the work provided for under the existing contracts for improving the Pawtucket River, Rhode Island, may be used in deepening the channel of said river to eighteen feet, and in increasing the widths thereof at such places between Pawtucket and Providence as may best subserve the interests of commerce: *Provided*, That the work herein authorized shall not be undertaken until the consent of the State of Rhode Island shall have been given for the application to this purpose of the portion of said balance heretofore contributed and pledged by said State.
>
> *Be it therefore resolved*, That the consent of the State of Rhode Island is hereby given for the application to the said purpose of the portion of the balance of the appropriation herefore contributed and pledged by the State of Rhode Island for said improvements of said Pawtucket River.

During the year 393,477 cubic yards of sand, gravel, clay, and mud, 70.581 cubic yards of bowlders exceeding in dimensions 1 cubic yard each, and 2,140.59 cubic yards of rock were removed.

The amount expended on the existing project up to June 30, 1909, exclusive of outstanding liabilities, was $70,890.08, by which about three-quarters of the 16-foot channel, 100 feet wide, has been dredged and about one-half of the channel through the rock has been excavated.

The mean rise and fall of the tide is about 5 feet.

The effect of the work thus far done on the new project is to afford a channel 16 feet deep to Phillipsdale, about 2 miles below Pawtucket, and to facilitate the handling of vessels in Pawtucket Harbor, but the full benefit of the 16-foot channel will not be experienced until the project is completed.

It is proposed to expend the sum of $20,000, estimated as a profitable expenditure for maintenance for the fiscal year 1911, in removing such shoaling as may have occurred in the completed portion of the channel.

The total amount of commerce on this river is 422,370 tons, chiefly coal, fish, oysters and oyster shells, and building materials, valued at $3,483,932.

For reference to report containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 84. Reference to report on preliminary examination ordered by the river and harbor act of March 3, 1905, will be found on page 92 of the report for 1906.

July 1, 1908, balance unexpended	$141,320.99
June 30, 1909, amount expended during fiscal year, for works of improvement	45,052.39
July 1, 1909, balance unexpended	96,268.60
July 1, 1909, outstanding liabilities	12,682.95
July 1, 1909, balance available	83,585.65
July 1, 1909, amount covered by uncompleted contracts	29,444.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,000.00

(See Appendix C 8.)

9. Providence River and Harbor and Narragansett Bay, and Green Jacket shoal, Rhode Island.—(a) Providence River and Harbor and Narragansett Bay.—The object of this improvement is to furnish a wide and deep channel for foreign and coastwise commerce from the ocean to Providence and to provide a deep-water anchorage for that harbor.

Before the improvement of the river in 1853 the available low-water depth was limited to 4.5 feet. Between 1852 and 1873, $59,000 was expended in securing first 9 feet and then 12 feet depth of channel.

The approved project of 1878, as modified in 1882, provided for deepening the river and deepening and widening its anchorage basins so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width from Fox Point to Fields Point, all at a total cost estimated in 1882 at $675,000. This project was completed in 1895.

Another project originating in the river and harbor act of June 3, 1896, provided for securing a ship canal 400 feet wide and of a depth of 25 feet at mean low water from Sassafras Point, in Providence Harbor, through Providence River and Narragansett Bay by the most direct route practicable to the ocean by way of the "Western Passage," so called, at an estimated cost of $732,820. This project was put under the continuing-contract system and the amount expended on the work up to the close of the fiscal year ending June 30, 1908, exclusive of outstanding liabilities, was $476,210.28, by which the channel 400 feet wide and 25 feet deep had been completed from Sassafras Point to the deep water of Narragansett Bay by the Western Passage.

Under date of June 11, 1904, the Chief of Engineers authorized the use of $2,000 of the balance remaining on hand of the appropriation for securing a channel through the Western Passage of Narragansett Bay for the removal of certain obstructing rocks in Dutch Island Harbor, Rhode Island.

The total amount expended on projects previous to the existing project was $1,174,700.87.

The existing project, adopted by the river and harbor act of June 13, 1902, provides for an enlarged anchorage area of 25 feet depth, extending the full width of the harbor from Fox Point on the north to Long Bed and Sassafras Point on the south, including the area known as Green Jacket shoal, at an estimated cost of $607,778. This project was enlarged by the river and harbor act of March 2, 1907, so as to include an area of uniform width and 25 feet deep to the eastward of the main ship channel, between Long Bed and Kettle Point, for which $90,750 was appropriated, making the total estimated cost $698,528. The river and harbor act of March 3, 1905, placed this work under the continuing-contract system.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $676,739.85, by which all approved projects have been completed.

The effect of the works of improvement under the existing project is to provide an anchorage area in Providence Harbor of about 288 acres with 25 feet depth, except that in some of the earlier portions of the work there has been some slight shoaling. The area improved includes all of Providence Harbor lying between Fields and Kettle points on the south and Fox and India points on the north, limited by the harbor lines on the east and west, except a triangular area containing about 27.5 acres in the southeast corner of the harbor, concerning which an estimate of the cost of removal was submitted February 4, 1908, and printed as House Document No. 919, Sixtieth Congress, first session, and a strip along the western side of the southern portion of the harbor containing 32.8 acres, the survey of which was authorized by the river and harbor act of March 3, 1909.

The only work contemplated is that of maintenance of the existing project, and it is proposed to apply to this purpose the existing balance and the allotment of $15,000 made from the appropriation of March 3, 1909.

It is proposed to apply the sum of $30,000, estimated for maintenance for the fiscal year 1911, to the maintenance of the anchorage area and of the channel leading from Providence Harbor to deep water in Narragansett Bay.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 85.

Reference to reports of examination and survey made in pursuance of act of March 2, 1907, will be found on page 97 of the Annual Report of the Chief of Engineers for 1908.

The commerce of Providence Harbor in 1908 was about 3,379,574 tons, chiefly coal, general merchandise, and fish, valued at $93,309,495.

(*b*) *Green Jacket shoal.*—This shoal was in that part of Providence River which constitutes the harbor of Providence. It lay off the wharves on the south front of the city and occupied a part of the harbor that is required for anchorage purposes, covering an area of about 18 acres between the 15-foot curves and about 30 acres in all.

In its original condition the shoal in many places carried only 1 foot of water and was a very troublesome obstruction.

The project for the removal of this shoal was adopted August 5, 1886.

The sum of $104,250 was expended on this work up to June 30, 1904, by which 23.8 acres out of the original 30 of this shoal had been dredged to 25 feet depth, and a 16-foot depth had been secured over the central and largest portion of the shoal, in addition to a 20-foot depth in the main channel, making an important addition to the anchorage facilities of Providence Harbor.

In the river and harbor acts of June 13, 1902, and March 3, 1905, provision was made for the removal of the remaining portions of this shoal in connection with the project for an enlarged anchorage area in Providence Harbor, and all of the remaining portions of the shoal were removed under the appropriations made by these acts.

There has been some shoaling over those portions of the area dredged prior to this year, which probably extends along the eastern side of the recently dredged anchorage area.

The effect of the improvement is stated in connection with the report on Providence Harbor.

For reference to reports containing more extended information see Annual Report of the Chief of Engineers for 1905, page 85.

July 1, 1908, balance unexpended	$126,130.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
Received from sale of material	2.77
	141,133.57
June 30, 1909, amount expended during fiscal year for works of improvement	104,342.65
July 1, 1909, balance unexpended	36,790.92
July 1, 1909, outstanding liabilities	41.76
July 1, 1909, balance available	36,749.16
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix C 9.)

10. Harbor at Newport, R. I.—This harbor is at the main entrance to Narragansett Bay, and throughout the year it serves as an easily accessible harbor of refuge to foreign and coastwise commerce.

Before improvement the capacity of the inner harbor was limited by shoals, and it was not adequate to the number and size of the vessels seeking it for refuge. The southern or main entrance was obstructed by a bar which stretched out from Goat Island and the northern entrance by a sharp, rocky spit near Rose Island, and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet. The mean tidal range is about 3.75 feet. Between 1873 and 1875, $28,500 was appropriated to secure 12 feet depth in the harbor. This work was completed in 1876.

The project adopted in 1880 and modified in 1882, 1883, 1884, 1890, and 1895 provided for widening and deepening the channel from Narragansett Bay into Newport, so as to secure 15 feet depth at mean low water with at least 750 feet width; for the extension of the 13-foot depth and 10-foot depth anchorage basins, and for dredging a channel 10 feet deep along the state harbor line southward to opposite the gas company's wharf; for the partial cutting off of the shoal spit at the southern end of Goat Island; for the construction of jetties on the western shore of Goat Island, so as to protect the end of this island from erosion and to prevent the drift of sand, etc., around the island into the adjacent parts of the harbor and channel; and for the removal of Spindle rock, a sharp, rocky spit near Rose Island; all at a total cost estimated in 1895 at $206,200.

The amount expended on the original and modified projects prior to operations under the existing project was $244,695.71, by which the projected work was completed.

The existing project, adopted by the river and harbor act of March 2, 1907, provides for dredging a channel 750 feet wide and 18 feet deep at mean low water around the southerly end of Goat Island and northward through the harbor, in accordance with House Document No. 121, Fifty-eighth Congress, second session, for the extension of the 13-foot anchorage area southward to the harbor line and the removal of Nourmahal rock in Brentons Cove off the Fort Adams shore, to a depth of 18 feet, in accordance with House Document No. 438, Fifty-ninth Congress, second session, at a total estimated cost of $250,900, which has been appropriated. The work has been carried on under a continuing contract.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1909, was $185,041.08, by which the project was completed, with the exception of the removal of some areas of ledge rock which were uncovered in dredging in the southern part of the harbor.

It is proposed to apply the existing balance to the removal of those portions of the ledge which form the most dangerous obstructions.

As the improvement of this harbor has progressed there has been a large increase in the size and number of vessels using it. The commerce for 1908 was about 200,530 tons, principally fish, coal, and general merchandise, valued at $9,246,164.

This includes freight passing through the harbor, but destined for other ports. It has become one of the most important harbors of refuge on the southern New England coast, and is much used as a point for breaking up and making up tows for coal barges and for the transshipment of fish.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 87.

July 1, 1908, balance unexpended	$120, 192. 70
Amount appropriated by sundry civil act approved March 4, 1909	53, 800. 00
	172, 992. 70
June 30, 1909, amount expended during fiscal year for works of improvement	107, 979. 30
July 1, 1909, balance unexpended	66, 013. 40
July 1, 1909, outstanding liabilities	4, 774. 34
July 1, 1909, balance available	61, 239. 06

(See Appendix C 10.)

11. Harbor of refuge at Point Judith, Rhode Island.—Point Judith is the southeastern extremity of the township of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay. A long ledge, known as "Squid Ledge," projects over a mile from the shore in a direction south by east about 1.5 miles west of the point.

This location was dangerous for vessels to pass during a storm, especially for the light-built barges transporting coal from New York Bay points to Narragansett Bay.

The existing project of September 19, 1890, provides for the construction at this point of a natural harbor of refuge nearly a square mile in area, by means of two stone breakwaters. The main breakwater, built partly on Squid Ledge, is approximately V-shaped, facing outward in a direction about south by west, and lying at a considerable distance from the shore. Eastward of the main breakwater a detached breakwater, nearly parallel to the line of the eastern arm of the main breakwater prolonged shoreward, was planned to shelter the eastern entrance, so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north, all at a total cost estimated in 1889 at $1,250,000. This project was modified by the report of a Board of Engineers convened to consider and report upon the construction of this harbor, which was approved November 16, 1896, and provided for raising the crest of the eastern arm and extending the western arm to its originally projected length, at an estimated cost of $444,311, and deferring the construction of the easterly detached breakwater as a part of the main project until the completion of the main breakwater should demonstrate its necessity or otherwise. The river and harbor act of June 13, 1902, made a further modification by providing for the construction of the easterly detached breakwater and continuing it to the shore, at an estimated cost of $196,193 for the detached breakwater and $187,558.80 for the shore extension. A further modification was made by the act of March 2, 1907, authorizing an extension seaward of the easterly breakwater at an additional estimated cost of $186,248.20, making the total cost of this breakwater $570,000 and a total estimate for the project and its modifications of $2,264,311.

The river and harbor act of March 2, 1907, provided for the further extension of the easterly breakwater under the continuing-contract system, appropriating $100,000 therefor and authorizing the expenditure of an additional $170,000 (appropriated by the sundry civil act of May 27, 1908) for its completion. Under date of May 11, 1907, a continuing contract was entered into for this extension. Work under this contract was commenced June 15, 1907, and it was completed January 11, 1909, and leaves an easterly opening into the harbor 1,200 feet in width. About $8,443.35 was expended during the year in repairs to the main breakwater.

The sum of $1,793,823.78 had been expended on this work up to June 30, 1909, of which $14,860.67 was for maintenance. By this expenditure the main breakwater had been built to a total length of 6,970 feet with a height of 10 feet above mean low water, and the easterly breakwater had been completed for a distance of 2,240 feet out from the high-water line on shore to about 30 feet depth of water.

Before the construction of the breakwater the area inclosed within the lines upon which it has been built and the shore was about 640 acres, of which 390 acres has over 25 feet of water and 198 acres additional over 18 feet. The 18-foot area and the whole water-covered area has since been considerably reduced by shoaling in the western part.

Proceedings for the condemnation of land required for the shore end of the breakwater are in progress. The decree condemning the land to the uses of the United States was entered on May 26, 1906, and the commission to assess the land damages viewed the land May 23, 1907. A hearing was held before the commissioners at Narragansett Pier on August 14, 1907, and at Providence, R. I., May 27 and 28, 1909.

About 79 per cent of the approved project with its modifications has been completed. The result of the improvement has been to create a harbor of refuge fairly suitable for sailing vessels and steamers, though the holding ground is poor, but not well suited for tows of barges, on account of the narrowness of the entrances, the direction of the entering courses with respect to that of the worst seas and the fact that the central part of the area is obstructed by a dangerous reef.

About 30 feet can be carried at mean low water into the eastern and from 18 to 19 feet into the western entrance. The mean range of tide is 3.1 feet.

Seven hundred and fifty-five vessels used the harbor during the fiscal year, of which 192 belonged to the contractor for construction and maintenance of the breakwaters. Of these 755, there were 301 schooners, 149 sloops, 64 steamers, 11 yawls, 117 tugs, and 113 barges; but 101 of the tugs and 91 of the barges belonged to the contractors.

The storms of the winter of 1908–9 accompanied by high tides damaged the breakwaters to some extent, which will be repaired with funds in hand.

The river and harbor act of March 2, 1907, provided for an examination with a view to further improvement of the harbor. The report of this examination was printed as House Document No. 911, Sixtieth Congress, first session, in connection with which matter House Document No. 935, Sixtieth Congress, first session, contains certain papers relating to Point Judith Harbor of Refuge, bearing upon its importance and the necessity for a landing pier at that place. No estimate is submitted for further work on the existing project for this locality pending action by Congress on the modified plan of improvement contained in the report of examination just mentioned.

July 1, 1908, balance unexpended		$193,049.99
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
Amount allotted from emergency appropriation by river and harbor act approved March 2, 1907		10,000.00
		213,049.99
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$158,386.81	
For maintenance of improvement	8,443.35	
		166,830.16
July 1, 1909, balance unexpended		46,219.83
July 1, 1909, outstanding liabilities		52.50
July 1, 1909, balance available		46,167.33
Amount (estimated) required for completion of existing project		444,311.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix C 11.)

12. Entrance to Point Judith Pond, Rhode Island.—Point Judith Pond is a shallow salt pond, lying in the rear of the sandy beach of the Rhode Island shore, just west of Point Judith. Before improvement it was frequently cut off from the ocean.

The improvement desired at this place by the people of the neighborhood is the widening and deepening of the present opening into the pond and the extension of jetties for the maintenance of such opening.

The State of Rhode Island and the town of South Kingstown are making the opening into the pond.

No general project for the improvement of this channel has been formed. The appropriations of $7,500 made in 1892, $2,500 in 1894, and of $2,000 in 1905 were expended in extending and strengthening the western jetty, originally built by the State, for the expenses of the Board of Engineers authorized by river and harbor act of June 13, 1902, and for surveys.

The river and harbor act of March 2, 1907, provides $8,000 for "continuing improvement and for maintenance," "which amount shall be expended for dredging."

In 1905 the excavated channel through the beach proper was about 3,000 feet long and carried a navigable depth of about 6 feet, but for a like distance beyond this point there was practically no navigable depth at low tide, there being a wide sand bar crossed by irregular streams rarely carrying as much as 1 foot of water. On the pond side of this bar there was about 5 feet depth. The difference of level between the pond and the ocean, together with the relatively small sectional area of the channel, is such as to create very strong currents. No dredging through this bar would be permanent without some auxiliary directing works to control the flow of the current. An appropriation of $6,000 was made at the 1907 session of the Rhode Island general assembly, and it was expected that the use of the combined appropriations might result in some benefit to the work, but the threatened cutting away of the sand behind the westerly jetty at the entrance to the pond made it necessary to use the state money in an effort to check this wash.

In the spring of 1909 it was found that a portion of the bar at the inner end of the channel had been carried farther into the pond, leaving a crooked channel through it, and still leaves a bar at the inner end of the new channel with about 3 feet of water on it at mean low water.

The mean range of tide is 3.1 feet.

No part of the 1907 appropriation for dredging of $8,000 has as yet been used.

The total expenditures to June 30, 1909, were $12,000, resulting in improving the entrance to the extent stated above. The locality is not deemed worthy of further improvement at present.

The commerce of the pond is very small and consists mainly of oysters caught in the Point Judith Pond, which are shipped by rail.

A report of the preliminary examination of this waterway was submitted April 13, 1909, in accordance with the provisions of the river and harbor act of March 3, 1909, reference to which will be found on page 100 of this report.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 90.

July 1, 1908, balance unexpended	$8,000.00
July 1, 1909, balance unexpended	8,000.00

(See Appendix C 12.)

13. Harbor of refuge at Block Island, Rhode Island.—This island is about 14 miles east of the eastern end of Long Island, and about 10 miles distant from the nearest point of the mainland.

The object of the improvement was to furnish a harbor of refuge for medium-draft vessels engaged in foreign and coastwise commerce.

Before the construction of the present harbor Block Island had no harbor at all.

The mean tidal range is about 3 feet.

Between 1870 and 1876, $285,000 was appropriated for a breakwater on the eastern side of the island for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882, $25,000 was appropriated for dredging an inner basin and the protection of the shore next to the breakwater, this work being completed in 1884. In 1884, $15,000 was appropriated for additions to the breakwater, this money being so spent and the work completed in 1884–85.

The project of 1884, as modified in 1888, provided for the construction of a harbor of refuge consisting of an inclosed inner harbor 800 feet square, protected by an L-shaped breakwater, for small vessels, and an exterior harbor for larger ones, protected by the original breakwater, at a total cost estimated in 1888 at $75,000. This project was practically completed in 1893.

The total expenditure prior to commencing work on the existing project was $400,575.17.

The existing project of June 3, 1896, provides for raising the entire breakwater to proper height and stopping sand leaks between certain points and dredging the main inner harbor to a depth of 10 feet, at an estimated cost of $83,985.

At the adoption of the present project this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

The sum of $118,172.39 had been expended on the existing project up to June 30, 1909, of which $17,983.47 was for maintenance. By this expenditure the entrance to the inner harbor, which had shoaled up from the drift of sand, had been partially dredged to a depth of 12 feet and redredged to a depth of 10 feet several times. The north wall of the inner harbor had been strengthened and repaired and the existing project completed. The accumulation of sand along the inner side of the original breakwater, as noted for a number of years, continues, and $12,500 was allotted from the appropriation made by the river and harbor act of March 3, 1909, for maintenance.

No work of improvement or maintenance was carried on during the year beyond a survey of the harbor and receiving proposals for redredging portions of the harbor which had shoaled since the previous work. The improvement provides an anchorage of about 17 acres, with a least depth of 10 feet at mean low water, 10 acres of which is within the walls of the inclosed inner harbor. The commerce of this harbor amounts to 11,861 tons, chiefly fish and general merchandise, valued at $591,873.

Reference to reports of an examination and survey made in pursuance of the act of March 2, 1907, will be found on page 97 of the Annual Report of the Chief of Engineers, U. S. Army, for 1908.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 91.

Further work awaits action of Congress on the project submitted in compliance with the provisions of the river and harbor act of March 2, 1907.

July 1, 1908, balance unexpended		$719.42
Amount allotted from appropriation by river and harbor act approved March 3, 1909		12,500.00
		13,219.42
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$132.08	
For maintenance of improvement	143.73	
		575.81
July 1, 1909, balance unexpended		12,643.61
July 1, 1909, outstanding liabilities		50.06
July 1, 1909, balance available		12,593.55
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		12,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix C 13.)

14. Great Salt Pond, Block Island, Rhode Island.—The Great Salt Pond is located about the center of Block Island and contains an anchorage area of 150 acres for vessels drawing 18 feet and over. The work of converting the pond into a harbor of refuge by making a channel through the beach on the west, connecting it with deep water in the ocean, was started by the State of Rhode Island and the town of New Shoreham.

The channel, under the existing project of June 3, 1896, as modified in 1900, is to be 600 feet wide and have a central depth of 25 feet for a width of 150 feet, sloping gradually to 12 feet in a width of 504 feet, the channel seaward to be protected on the south by a jetty extending to 350 feet beyond the original 18-foot contour and on the north by a jetty about 1,200 feet long, and the sides of the channel where it passed through the original beach to be protected by stone revetments and sand fences, at a total estimated cost of $305,000.

At the time the work commenced under the General Government a channel of varying width and depth had been dredged with the money appropriated by the State and town, which would permit of 12-foot draft being carried in.

The south jetty had been built out 837 feet, and a north jetty 250 feet long had also been built, but at a distance of 720 feet from the south jetty instead of 600 feet, as called for in the adopted project.

The mean rise and fall of the tide is about 3 feet.

Up to June 30, 1909, $198,979.89 had been expended by the General Government on the existing project, of which $9,943.24 had been used for maintenance and repair. By this expenditure the south jetty had been extended 439 feet beyond the originally projected length, making a total of 1,691 feet from the initial point on shore. Some damage done by a severe storm in the spring of 1900 had been repaired. The 25-foot deep channel 150 feet wide had been completed, and a cut 23 feet deep and 30 feet wide had been made on either side of it, that on the northerly side of the channel going but about halfway through. The 18-foot depth had been dredged to a width of 300 feet.

During the last fiscal year a survey of the entrance has been made. The dredge *Gedney*, transferred to this district in the latter part of June, was engaged two days in dredging sand that had accumulated in the channel.

There remains to complete the existing project the construction of jetties as planned and dredging to secure the widths and depths projected, and the appropriation asked for will be applied to this work.

The work required to complete the existing project is for the purpose of extending the benefits of the improvement.

The commerce of this harbor amounts to 10,458 tons, chiefly of fish and general merchandise, valued at $636,425. During the summer season a large number of passengers is carried to Block Island through this harbor.

Provision was made in the river and harbor act of March 3, 1909, for a preliminary examination and survey of the inner harbor of the Great Salt Pond, report of which will be submitted as soon as possible.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 92.

July 1, 1908, balance unexpended		$8,848.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909		12,500.00
		21,348.59
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$7,688.48	
For maintenance of improvement	140.00	
		7,828.48
July 1, 1909, balance unexpended		13,520.11
July 1, 1909, outstanding liabilities		946.33
July 1, 1909, balance available		12,573.08
Amount (estimated) required for completion of existing project		105,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909		105,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix C 14.)

15. Removing sunken vessels or craft obstructing or endangering navigation—Schooner Harry Messer, Steamer Horatio Hall, Schooner Jennie French Potter.

(*a*) Schooner *Harry Messer*, a three-masted wooden schooner, was sunk on the northeast part of Handkerchief Shoal, Nantucket Sound, Massachusetts. Removal commenced February 10, 1909; completed March 1, 1909. The total cost of removal was $898.99.

(*b*) Steamer *Horatio Hall* was sunk in collision in Pollock Rip Slue, eastern entrance to Nantucket Sound, March 10, 1909. Work of removal commenced April 12 and was completed June 28, 1909. The total cost of removal was $3,441.56.

(*c*) Schooner *Jennie French Potter*, a five-masted wooden schooner, was sunk on Half Moon Shoal, at the eastern end of Horse Shoe Shoal, about 1¾ miles north, northeast of Cross Rip Light-Ship, Nantucket Sound, Massachusetts. The wreck was reported as a dangerous obstruction to navigation and removal recommended June 28, 1909.

(See Appendix C 15.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1909.

Report dated April 13, 1909, on preliminary examination of *Point Judith Pond, Rhode Island, and the entrance thereto*, with a view to obtaining a navigable depth, required by the river and harbor act of March 3, 1909, was duly submitted by the district officer. It was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and was transmitted to Congress and printed in House Document No. 79, Sixty-first Congress, first session. The locality is not considered worthy of improvement at the present time by the General Government in the manner proposed.

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and survey required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination and survey of New Haven Harbor, Connecticut with a view to determining whether a greater depth is needed, also the rocks in Morris Cove.*—Reports dated May 15, 1907, and July 31, 1908, respectively, are printed in House Document No. 1159, Sixtieth Congress, second session. Two plans of improvement are presented, estimated to cost $68,000 and $212,000, respectively.

2. *Preliminary examination of Connecticut River between Hartford, Conn., and Holyoke, Mass.*—Report dated October 31, 1908, is printed in House Document No. 1311, Sixtieth Congress, second session. The locality is not considered worthy of improvement by the General Government on account of the cost being out of proportion to the probable benefits.

IMPROVEMENT OF RIVERS AND HARBORS IN THE NEW LONDON, CONNECTICUT, DISTRICT.

This district was in the charge of Maj. Harry Taylor, Corps of Engineers. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. *Pawcatuck River, Rhode Island and Connecticut.*—The navigable part of the Pawcatuck River extends 5 miles from Westerly, R. I., to its outlet, in Little Narragansett Bay, through the northern part of which a navigable channel extends 2½ miles to Stonington Harbor, Connecticut, through which Long Island Sound is reached.

Before improvement the channel of the river was crooked and obstructed by numerous shoals, on some of which there was 1 to 1½ feet of water, and the greatest depth that could be carried through the bay channel was 4½ feet.

The original projects, that of 1871 for the river channel and that of 1879 for the channel across the bay, provided for depths of 5½ and 7 feet and widths of 75 and 200 feet, respectively. The expenditure on the original projects was $97,500.01.

The present project, adopted in 1896, provides for a channel 10 feet deep from Stonington, Conn., to Westerly, R. I., with a width of 200 feet from Stonington to Avondale, R. I., a distance of about 4 miles; a width of 100 feet from Avondale to the lower wharves at Westerly, a distance of about 3 miles, and a width of 40 feet between the upper and lower wharves of Westerly, a distance of about one-half mile, at a total estimated cost of $200,361.60. The river and harbor act of March 3, 1905, authorized the use of $1,000 of the appropriation for the improvement of the Pawcatuck River in the removal of obstructions at Watch Hill, at the southeastern part of the Little Narragansett Bay. The greater portion of the obstructions was removed in January and February, 1906, at a cost of $865.82.

On this project $72,094.96 had been expended to June 30, 1909, therewith completing the section 40 feet wide along the wharves of Westerly, extending the 100-foot channel downstream 1,800 feet, making a channel through Little Narragansett Bay 100 feet wide and 10 feet deep and extending the 100-foot channel upstream to within 2,000 feet of the channel extended downstream from Westerly. Of this amount $15,080.41 was applied to maintenance. The project is about 25 per cent completed.

The maximum draft, which could be carried June 30, 1909, was 10 feet in the bay channel, 7 feet in the river, and 6 feet near Watch Hill. The mean rise of tide is 2.6 feet at the mouth of the river and 2.3 feet at Westerly.

The effect of the improvement is to permit coal, lumber, and building material to be delivered in vessels at Westerly, and to ship therefrom granite in vessels instead of by rail, thus giving water competition for these materials, with a resulting benefit in the reduction of freight rates.

The available balance and the appropriation asked for will be applied toward maintenance and the completion of the project.

The reported tonnage for 1908 was 59,037, valued at $303,775.53.

July 1, 1908, balance unexpended	$25, 459. 74
June 30, 1909, amount expended during fiscal year, for works of improvement	19, 554. 71
July 1, 1909, balance unexpended	5, 905. 03
July 1, 1909, outstanding liabilities	5, 772. 25
July 1, 1909, balance available	132. 78
July 1, 1909, amount covered by uncompleted contracts	100. 00
Amount (estimated) required for completion of existing project	138, 342. 01
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15, 000. 00

(See Appendix D 1.)

2. *New London Harbor, Connecticut.*—New London Harbor, which comprises the lower 3 miles of the Thames River, has a navigable width of one-quarter to 1¼ miles and depth of 26 feet or more in the main channel from Long Island Sound to the railroad drawbridge which crosses the river above the New London dock front. This channel, especially opposite New London, follows the east bank. Between it and the city docks is a nearly level area having a general depth of 10 to 15 feet. Before improvement part of the docks were accessible to vessels of 16 to 18 feet draft at high tide only.

The original and present project, adopted by the act of June 13, 1902, provides for dredging and maintaining a ship channel 400 feet or more in width, 23 feet deep, and about 6,000 feet long. This channel leaves the deep water of the river opposite Fort Trumbull on the west side, skirts the water front of the city, including that of Winthrop Cove, to the Central Vermont Railroad bridge and the east side of the Central Vermont dock, and joins the natural deep channel at a distance of about 4,000 feet upstream from the point of beginning. The estimated cost of the improvement was $145,000, and $1,000 per annum for maintenance. For map see House Document No. 392, Fifty-sixth Congress, first session.

Up to June 30, 1909, $141,400 had been expended on the project.

The project dredging was completed under a continuing contract in October, 1904. This completed the project except at two small areas of ledge rock in the Fort Trumbull-Shaws Cove arm of the channel, where there were depths of about 18 feet, and at a part of a city pipe sewer crossing the middle of the dredged channel, where the least depth was 21.6 feet. The rock in the channel was removed in 1907. A draft of 23 feet can be carried to opposite all the principal docks. The additional work proposed is to maintain the improvement.

The effect of this improvement has been to materially reduce freight rates.

The mean range of tide is 2.6 feet.

Under a modification of the existing Thames River project, adopted in 1892, Shaws Cove, a branch of New London Harbor, has been dredged to 12 feet.

The reported tonnage of this port for the year 1908, principally coal, building material, oil, and steamboat freight, and exclusive of that pertaining to Shaws Cove and Thames River, was 746,967, valued at $12,753,777.83.

Reference to reports on examination and survey made in pursuance of act of March 2, 1907, will be found on page 122 of report for 1908.

July 1, 1908, balance unexpended		$5,919.41
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$319.41	
Carried to the surplus fund	3,600.00	
		3,919.41
July 1, 1909, balance unexpended		2,000.00

(See Appendix D 2.)

3. *Thames River, Connecticut.*—This is a tidal stream from Norwich, Conn., the head of navigation, to Long Island Sound, a distance of 15 miles. For 4 miles below Norwich the natural depths were 6 feet or more at low water with widths of 400 to 1,000 feet. Below this point depths were 13 feet or more and widths 800 to 3,000 feet.

The original project, adopted in 1836, provided for a channel 11 feet deep at low water, to be secured by dredging and building dikes. On this project $40,300 had been expended when, in 1839, work was stopped, the project not having been completed.

The existing project, adopted June 23, 1866, and modified in 1879, 1882, 1888, 1892, and 1907, is to dredge and build training walls to secure a channel 200 feet wide with depths of 20 feet from New London to Allyns Point and 14 feet thence 5 miles to Norwich; also to dredge Shaws Cove at New London to a depth of 12 feet. Estimates of cost were $473,870 for construction and $9,500 annually for maintenance.

Up to June 30, 1909, $472,151.76 had been expended on this project and its modifications, of which $32,308.57 had been applied to maintenance. The project had been completed, except that part of the channel between Allyns Point and Norwich was somewhat deficient in width. Mean range of tide is 2.6 feet at New London and 3.1 feet at Norwich.

The balance on hand and the appropriation recommended will be applied to maintenance of the improvement.

Commerce at Allyns Point is coal, and at Norwich and intermediate landings it is mainly coal, lumber, cotton and wool, and steamboat freight. The reported tonnage for 1908 was 443,395, valued at $2,265,350.51, including 22,561 tons, valued at $121,380.50, for Shaws Cove commerce.

The work done has reduced the cost of transportation by enabling freight to be brought in vessels of 16 and 18 foot draft instead of 8-foot draft. The river commerce of the present day could not be carried except for the increased depths thus obtained.

The modification of project adopted by act of March 2, 1907, is printed in House Document No. 265, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$29,434.69
June 30, 1909, amount expended during fiscal year, for works of improvement	13,986.45
July 1, 1909, balance unexpended	15,448.24
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix D 3.)

4. *Connecticut River between Hartford, Conn., and Holyoke, Mass.*—This portion of the river is 34 miles long, and is naturally divided into three distinct sections. From Hartford to the foot of Enfield Rapids, 10½ miles, the river has a gentle slope, with a sandy, shifting bottom; from the foot to the head of Enfield Rapids, 5½ miles, the total fall at low water is 32 feet, and the bed of the river is largely rock; from Enfield Falls to Holyoke, 18 miles, the river is of moderate width, gentle slope, fair depth, and stable bottom.

In its original condition the lower section had a navigable depth of 2 feet or less at low water; the second section could be navigated upstream only with great difficulty and only by boats of shallow draft; the third section was navigable by boats drawing 4 to 5 feet of water.

At Enfield Rapids a canal with locks 80 feet in length and 18 feet in width, designed for boats with draft of about 3 feet at low water, has been constructed by private enterprise as part of a water-power development scheme.

Prior to June 30, 1898, $93,059.70 was expended in the construction of wing dams and dredging to provide a temporary improvement below Enfield Rapids, and in extensive surveys and examinations which were made with a view to permanent improvement of the whole stretch from Hartford to Holyoke.

No work of improvement has been carried on in this section of the river since 1886.

A complete history of the improvement of this section of the river, up to that date, with maps and plans, is given in the Annual Report of the Chief of Engineers for 1878, pages 248–391.

Examinations and surveys with a view to future permanent improvement have been made under the river and harbor acts of June 3, 1896, June 13, 1902, and March 3, 1905. The Board appointed by authority of the last-named act suggested three plans of improvement other than those which had been already reported upon. One of these plans provided for dredging, the use of wing dams and training walls, and rock excavation from Hartford up to a point above the mills at Windsor Locks; thence by a new lock and the upper portion of the existing canal, and thence to Holyoke, at a cost of $1,465,600. This plan was approved by the Board of Engineers for Rivers and Harbors, provided that all rights claimed to be infringed by this work should be ceded to the United States without cost. The amount expended on this survey was $22,838.47.

The appropriation of March 2, 1907, was for the purpose of investigation and further examination, in accordance with the recommendation of the Board of Engineers for Rivers and Harbors referred to, to determine what rights might be infringed and if they could be obtained without cost to the United States. A report of the result of this examination is printed in House Document No. 1311, Sixtieth Congress, second session. The company claiming the rights declined to cede them without payment.

To June 30, 1909, the amount expended from the appropriation of March 2, 1907, was $313.55.

No permanent benefit has resulted from the work thus far done.

July 1, 1908, balance unexpended		$6,951.21
June 30, 1909, amount expended during fiscal year:		
For maintenance of improvement	$103.23	
Carried to the surplus fund	1,846.26	
		1,949.49
July 1, 1909, balance unexpended		5,001.72

(See Appendix D 4.)

5. *Connecticut River below Hartford, Conn.*—The part of the river under improvement is 50 miles long from Long Island Sound to Hartford. Beyond Hartford the river is navigable, by means of a small private canal at Windsor Locks, Conn., 34 miles to Holyoke, Mass., although the navigation is limited by reason of low fixed bridges and the inadequacy of the canal. Before beginning improvement below Hartford the available depth over Saybrook bar at the

mouth of the river was 7 feet, and thence to Hartford at the shoalest of the river bars about 5 feet.

The original project, adopted in 1836, provided for the removal of the Saybrook bar by dredging. Up to 1843 an 11 to 12 foot channel had been dredged 50 feet wide and 1,500 feet long, at a cost of $23,471.57. No further work was done until 1870, by which time the dredged channel had been nearly obliterated by storms and freshets.

A project for permanent improvement was adopted in 1870 and modified in 1873 and 1880, under which two jetties were built at Saybrook bar and dikes constructed at Hartford and Glastonbury bars; but operations under this project have been abandoned.

The existing project, adopted in 1887 and modified in 1890, provides for maintaining the navigable channel by completing two jetties at Saybrook bar to a height of 5 feet above high water, with top width of 6 feet and side slopes of 1 on 1; raising the training wall, nearly 3,700 feet long, at the Hartford bars as may be found necessary by experience, but not to exceed 15 feet above low water; dredging the channel between the jetties to 12 feet depth and width of 400 feet and maintaining the channel by annual dredging at the various river bars to about 10 feet depth at mean low water and to a width as near 100 feet as practicable, at an estimated cost—

Completing Saybrook jetties	$60,000
Dredging channel between them	20,000
Raising Hartford dike	50,000
Total	130,000

and $10,000 annually for dredging for maintenance.

For scope and history of the modifications, see pages 120 and 121, Annual Report of the Chief of Engineers for 1900.

The act of June 13, 1902, authorized an expenditure of $1,000 for removal of obstructions at mouth of Salmon River, a tributary to the Connecticut River.

Up to June 30, 1909, $590,300.24 had been expended on this improvement, of which $338,157.62 had been applied to maintenance. The project is about 50 per cent completed.

The maintenance of the river-bar channels by annual dredging has been held paramount in the project. A channel 200 feet wide and 12 feet deep at mean low water, which has been dredged through Saybrook bar between the jetties, has been well maintained by the jetties, and annual dredging at the river bars has generally kept a half-width channel open so that Hartford-New York steamers and barges drawing from 9 to 11 feet, according to the river stage, have been but little detained, and then only at summer low river and before completion of the annual dredging. The maximum draft which could be carried at mean low water over the shoalest river bar on June 30, 1909, was 10 feet. The mean rise of tide is 3.6 feet at Saybrook jetties and on low river 1.5 feet at Hartford.

Sketches of the Connecticut River from Hartford to Rocky Hill and of Saybrook bar are printed in the Annual Report of the Chief of Engineers for 1885, page 636. The river from the Sound to Hartford is shown on Coast Survey charts 253–256.

The reported tonnage for the year 1908 amounted to 515,581 tons, mainly coal, lumber, building materials, and miscellaneous steamboat freight, valued at $14,001,989.

The work done has reduced freight rates to Hartford and lower river ports materially, and has also greatly facilitated the delivery of coal and other freight. Without the improvements there could be but little freight traffic on the river.

The available balance and the additional appropriation asked for will be applied to maintenance and continuing work on the approved project.

July 1, 1908, balance unexpended		$32,976.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		47,976.50
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$13,815.77	
For maintenance of improvement	12,762.54	
		26,578.31
July 1, 1909, balance unexpended		21,398.19
July 1, 1909, outstanding liabilities		4,885.51
July 1, 1909, balance available		16,512.68
July 1, 1909, amount covered by uncompleted contracts		8,227.45
Amount (estimated) required for completion of existing project		95,665.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		42,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix D 5.)

6. *Harbor of refuge at Duck Island Harbor, Connecticut.*—Duck Island Harbor is a bay on the north shore of Long Island Sound about 7 miles west of the mouth of the Connecticut River and midway between the harbors of New London and New Haven.

The project for this improvement, adopted by the act of September 19, 1890, provides for the construction of three riprap breakwaters of 3,000, 1,750, and 1,130 feet length, respectively, inclosing and sheltering an area of about 115 acres, with two entrances. The project height of the breakwaters is 10 feet above low water, with crown of 10 feet and slopes of 2 on 3 outside and 1 on 1 inside. The estimated aggregate cost is $463,540. For map see Annual Report of the Chief of Engineers for 1887, page 644, and House Document No. 398, Sixtieth Congress, first session.

To June 30, 1909, $116,309.25 had been expended, of which $5,334.10 was for maintenance, and 2,697 linear feet of the west breakwater had been built, but with reduced cross section, extending westwardly from Duck Island to a low-water depth of 17 feet. The mean rise of tide is 3.8 feet.

No estimate is submitted for further work on the existing project for this locality, pending action by Congress on a modified plan of improvement contained in House Document No. 398, Sixtieth Congress, first session, based on examination and survey authorized by the river and harbor act approved March 2, 1907.

The project is about 25 per cent completed. The commerce to be benefited by this improvement is the passing commerce of Long

Island Sound, which may find it necessary or convenient to seek shelter at this locality. Its value can not be satisfactorily estimated.

During the year 1908, 1,003 vessels were reported as having anchored in the harbor, which, in its present condition, affords but a very small percentage of the shelter it would if completed.

July 1, 1908, balance unexpended	$3,892.75
July 1, 1909, balance unexpended	3,892.75
Amount (estimated) required for completion of existing project	349,540.00

(See Appendix D 6.)

7. *Branford Harbor, Connecticut.*—Branford Harbor consists of three distinct parts: The outer harbor, approximately 1 mile wide and three-quarters of a mile deep; the inner harbor, about half a mile in diameter, separated from the outer harbor by a series of rocks, the principal ones of which are known as "The Mermaids;" and the river, which empties into the inner harbor from the northeast. The natural low-water depths when improvement began were: At the outside of the outer harbor, 15 to 16 feet, gradually shoaling to 8 feet near "The Mermaids;" through the inner harbor from "The Mermaids" to the mouth of the river, 7 to 8 feet; up the river for a distance of 1 mile, nearly to the lower docks, 12 feet or more. From the lower to the upper docks the channel gradually shoaled and narrowed so that the controlling depth was less than 6 feet and the width 25 to 50 feet. At the upper dock the stream is crossed by an earthen causeway, in which there is a small drawbridge which is rarely opened, although the stream is navigable for small craft to a fixed bridge about one-half mile above. Since the adoption of the present project a very general and uniform shoaling of 1 to 2 feet has taken place in the inner harbor, so that the controlling depth between "The Mermaids" and the mouth of the river, the shoalest place in the channel, was only about 6 feet.

The original and present project, adopted by the act of June 13, 1902, and modified by the act of March 2, 1907, provides for an 8½-foot channel 100 feet wide in the upper part of the river between the lower and upper docks and through the shoals at the mouth of the river, at an estimated first cost of $13,000.

This project was completed July 30, 1907, at which time channels of full project dimensions had been dredged from the 8½-foot curve in the lower harbor through the inner harbor to the mouth of the river, and in the upper portion of the river from below the lower docks upstream to the upper docks.

This work greatly facilitates navigation, and the effect of the improvement has been to reduce freight rates.

The maximum draft that could be carried June 30, 1909, from the entrance of the harbor to the head of the proposed channel was about 7 feet at mean low water in the lower harbor and 8½ feet in the river. The mean rise of tide is about 6.5 feet.

For report of survey upon which the present project is based, see Annual Report of the Chief of Engineers, 1901, page 1189 et seq. Reference to reports on examination and survey made in pursuance of act of March 2, 1907, will be found on page 122 of report of 1908.

The amount expended on this project to June 30, 1909, was $11,221.63, of which $1,684.18 was for maintenance.

The commerce of this harbor is mainly coal, molding sand and clay, iron, and lumber. The tonnage reported for 1908 amounted to 20,669 net tons, valued at $100,362.80.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

July 1, 1908, balance unexpended	$1,851.69
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	73.32
July 1, 1909, balance unexpended	1,778.37
July 1, 1909, outstanding liabilities	20.67
July 1, 1909, balance available	1,757.70
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix D 7.)

8. *New Haven Harbor, including West River, Connecticut.*—New Haven Harbor is formed by a bay on the north side of Long Island Sound, which extends inland about 4 miles and is from 1 to 2 miles wide. Mill and Quinnipiac rivers, navigable for about 1 and 3 miles, respectively, above their mouths, empty into the head of the harbor from the northeast. The original available low-water depth from the wharves to Cranes bar, one-third way down the harbor, was 9 feet; thence to Fort Hale, halfway down, it was 16 feet or over. Below Fort Hale was a broad bar of soft mud extending across the channel, with available depth of 13 feet. The harbor entrance was partly obstructed by several sunken rocks. In Quinnipiac River the available low-water depth was about 4 feet, and in the west branch of Mill River about 5 feet to the head of the present projected improvement. Above this point both rivers are for the most part available for navigation only at high tide. The entire east branch of Mill River ran nearly bare at low tide.

In 1870 a project was adopted for removal of sunken rocks at the harbor entrance. This work was not continued after 1875, when the harbor breakwaters were first proposed. In 1871 the project was extended to include deepening the harbor channel, the proposed depth and width being modified from time to time as appropriations were made until 1899, when the project provided for a channel 16 feet deep and from 400 to 700 feet wide from Long Island Sound to the head of the harbor and for a dike to contract the channel across Fort Hale bar, at a total estimated cost from beginning of $348,000. This project was nearly completed, the deficiencies being in the length of channel arm of the dike, which was about two-thirds the projected length, and in the width of the channel across Fort Hale bar, which was only 200 feet wide. The total amount expended on these projects was $325,695.66.

The project adopted by the act of March 3, 1899, provided for a channel 20 feet deep, 400 feet wide, and 4 miles long from Long Island Sound to Canal dock; thence of same depth, 300 feet wide. one-half mile to Tomlinson Bridge; three anchorage basins below Tomlinson bridge of 20, 16, and 12 feet depths; a channel up the Quinnipiac River 200 feet wide and 12 feet deep to Grand avenue;

and a channel up the Mill River 12 feet deep and 200 feet wide to the junction of the two branches above Chapel street, and thence 12 feet deep and 75 feet wide up each branch to Grand avenue. The act of March 3, 1899, making the first appropriation for this project, limited it to the portion below Tomlinson Bridge, but the act of June 13, 1902, authorized the extension to the part above Tomlinson Bridge, provided the cost should not exceed $345,000, the amount authorized by the act of 1899. The above project, including the improvement of the Quinnipiac and Mill rivers, except that part of the Quinnipiac River between Ferry street and Grand avenue, was completed April 26, 1904, mainly under continuing contract, and a channel 8 feet deep and 50 feet wide dredged in the Quinnipiac River between Ferry street and Grand avenue. The total appropriated for the project adopted by the act of 1899, exclusive of maintenance, amounts to $280,073.90, being less than the authorized cost of the project by $64,926.10.

For reference to maps and further details regarding the harbor and projects, see Annual Report of the Chief of Engineers, 1904, page 94.

West River lies between the city of New Haven and the town of West Haven. The head of navigation is at a railroad bridge about one-half mile upstream from the Kimberly Avenue Bridge. About 500 yards below this drawbridge the river widens into a shallow bay and joins New Haven Harbor south of Oyster or City Point. The natural channel, about 2,000 yards long through the middle of the bar, carried less than 3 feet at its shoalest part. A channel leading from the harbor to docks at Oyster Point had a controlling depth of 4.5 feet, but between Oyster Point and the channel along the West Haven docks was a wide flat nearly bare at low tide.

The project adopted by the river and harbor act of March 3, 1905, for improvement of West River, provided for a 9-foot channel, 100 feet wide, from the downstream corner of the 16-foot anchorage basin of New Haven Harbor, via Oyster Point and the dock frontage of West Haven, to Kimberly Avenue Bridge, at a cost of $38,500, and $500 for annual maintenance.

The report of survey of West River is published at page 996 and following, Annual Report of the Chief of Engineers, 1904, and the survey map is printed in House Document No. 73, Fifty-eighth Congress, second session.

The river and harbor act of March 2, 1907, consolidated the improvement of West River with that of the main harbor, of which the former is a branch.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $350,025.07, of which $38,318.86 was for maintenance. Of the amount reported expended on existing project $38,500 was expended on West River prior to its consolidation with the general project.

The project of 1899 for the main harbor is about 80 per cent completed and the channel in West River contemplated by the project of 1905 completed.

The maximum draft which could be carried June 30, 1909, through the main channel to Tomlinson bridge was 19 feet at mean low tide; above Tomlinson bridge the maximum low-water draft which could be carried up Mill River to Grand Avenue bridge was 12 feet in both branches; up Quinnipiac River to Ferry Street Bridge 12 feet, and from Ferry Street Bridge to Grant avenue a little more than 6 feet;

and up West River to Kimberly avenue 9 feet. The mean rise of tide is 6.5 feet at entrance to the harbor and 6.6 feet at Tomlinson bridge.

The work done has enabled deeper-draft vessels to use the harbor than was formerly possible, with the resulting reduction of freight rates due to the larger vessels and increased facilities for handling freight made possible thereby.

The commerce of New Haven harbor is mainly in coal, steamboat freight, shellfish and shells, lumber, steel billets, and pig iron. The reported tonnage for the calendar year 1908 was 1,921,123 tons, valued at $98,233,543.22.

The available balance and the appropriation asked for will be applied to maintenance and to continuing the approved project.

July 1, 1908, balance unexpended	$2,083.44
Amount allotted from emergency appropriation, river and harbor act approved March 2, 1907	3,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	25,083.44
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,230.27
July 1, 1909, balance unexpended	19,853.17
July 1, 1909, outstanding liabilities	83.00
July 1, 1909, balance available	19,770.17
July 1, 1909, amount covered by uncompleted contracts	10,668.00
Amount (estimated) required for completion of existing project	64,926.10
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix D 8.)

9. *Breakwaters at New Haven, Conn.*—The original and existing project for this work, authorized by act of March 3, 1879, and approved January 31, 1880, and modified by act of September 19, 1890, in accordance with plans given in Annual Report of the Chief of Engineers, 1889, page 678, is to make a harbor of refuge at the entrance to New Haven Harbor by constructing four breakwaters—one 3,300 feet long, extending from Southwest ledge to Quixes ledge; one 5,000 feet long, extending from a point 1,000 feet north 54° east from Ludington rock, in a direction south 54° west across the rock; one about 4,200 feet long, extending northwesterly from a point 6,000 feet south 54° west from Ludington rock, and one about 1,200 feet long, extending southwesterly from Morgan Point on the east side of the harbor entrance—the cross section of all these breakwaters to be 12 feet wide on top and 6 feet above mean high water, with outer slope 1 on 2 and inner slope 1 on 1. The estimated cost from the beginning, in 1880, was $2,151,134. The anchorage which will be sheltered by the breakwaters exceeds 2,000 acres, of which over 500 acres has depths of 20 to 28 feet, and the remainder is 9 to 20 feet deep. The mean rise of tide is 6.5 feet.

For original report on project, see Annual Report of Chief of Engineers, 1880, page 449 et seq., and for modification of project and maps showing the location of the breakwaters as contemplated under the existing project see Annual Report of the Chief of Engineers for 1889, page 678 et seq.; 1890, pages 624 and 625, and 1896, page 702.

At the close of the fiscal year the breakwater from Southwest ledge to Quixes ledge had been completed 3,450 feet long; 4,450 feet of the Ludington rock breakwater had been built, but with steeper slopes than called for by the project, and work was in progress on the west breakwater, which had been extended a total distance of 2,850 feet, of which the first 2,655 feet from the easterly end was very nearly completed and the remainder was about 5 feet below low water. The project is about 75 per cent completed.

The total expenditure to June 30, 1909, was $1,004,455.11, of which $8,751.91 was for maintenance.

The commerce now benefited and to be further benefited by this work is mainly the passing commerce of Long Island Sound. The projected breakwaters provide also an outer anchorage for vessels bound to and from New Haven and help to protect the entrance to New Haven Harbor proper from seas and to diminish channel filling. For the calendar year 1908 some 5,630 vessels sought refuge behind the breakwaters. The additional work proposed is for extension of benefit to commerce.

The available balance and the appropriation asked for will be applied to continuing construction of the west breakwater and to maintenance.

The river and harbor act of March 2, 1907, authorized continuing contracts for the prosecution of this work to the amount of $250,000, all of which has now been appropriated; such a contract was entered into June 11, 1907. Work under this contract was begun September 4, 1907, and was in progress at close of fiscal year.

July 1, 1908, balance unexpended	$170,070.45
June 30, 1909, amount expended during fiscal year for works of improvement	45,525.56
July 1, 1909, balance unexpended	124,544.89
July 1, 1909, outstanding liabilities	23,008.35
July 1, 1909, balance available	101,536.54
July 1, 1909, amount covered by uncompleted contracts	81,153.61
Amount (estimated) required for completion of existing project	1,030,885.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix D 9.)

10. Milford Harbor, Connecticut.—This harbor is on the north shore of Long Island Sound, and consists of a broad, open bay, from the head of which a small tidal stream extends nearly a mile inland to the head of navigation. The original depth on the bar in the bay at the mouth of the river was less than 2 feet. In parts of the river the channel ran nearly bare. The mean rise of tide is about 6.2 feet.

The original project, adopted under the act of June 23, 1874, provided for a riprap breakwater 890 feet long from Welchs Point, on the east side of the mouth of the harbor, protection of the bluffs on the east shore from erosion by means of small stone jetties, a jetty on the east side to maintain the river-bar channel, and dredging a channel 4 feet deep and 100 feet wide across the bar, the whole estimated to cost $85,000. This project was modified in 1878 and 1879 to provide for extending the 4-foot channel 60 feet wide upstream to the town dock and for a training dike off Burns Point, on the west side of the river channel, nearly at right angles to the east-side jetty. The project thus modified was completed in 1880, except that the outer breakwater was not built, being deemed unnecessary in view of the provision of a harbor of refuge at New Haven. Under the act of June 14, 1880, a project was adopted for the extension of the 4-foot channel, 40 feet wide, upstream to the Straw Works wharf, and under the act of August 2, 1882, a revised project was adopted which provided for a channel 8 feet deep and 100 feet wide across the bar and upstream to Merwin's dock, at estimated cost of $11,000.

In 1891 these projects were reported as completed and no further work necessary, except maintenance of jetties and dredged channels. It was stated in July, 1895, that as a result of private dredging there was a clear channel across the bar 12 feet deep and nowhere less than 80 feet wide. On the previous projects $45,500, and for surveys $1,600, were expended.

For further details regarding former projects see Annual Report of the Chief of Engineers for 1893, page 929, and for report on which present project is based see Annual Report of the Chief of Engineers for 1900, page 1357 et seq. For map see House Document No. 280, Fifty-sixth Congress, first session.

The existing project, authorized by act of June 13, 1902, for completion at a cost of $15,000, consists in dredging and maintaining a channel across the bar and through the lower harbor, 100 feet wide and 10 feet deep, to Merwin's wharf, with an anchorage basin of same depth of about 5 acres area on the east side of the channel between the long dike and the harbor line, and a channel through the upper harbor from Merwin's wharf to the Straw Works wharf, 90 feet wide and 6 feet deep. The estimated cost for maintenance was $1,000 biennially. The first cost of the improvement was subsequently ascertained to be $25,000. The amount expended on this project to June 30, 1909, is $23,673.46, of which $23.84 was for maintenance.

The 6-foot channel has been extended upstream to a point about 500 feet above the town dock, a portion of the anchorage basin, about 2⅓ acres in area, adjacent to the 10-foot channel, dredged, and a basin, 1.6 acres in area, dredged on the opposite side of the channel opposite Merwin's wharf. Owing to ledge rock it was impracticable to complete this project within the estimate. The work done facilitates navigation in the lower part of the harbor, and the extension of the 6-foot channel to the town dock renders it practicable to land cargoes of coal at this dock, which it was formerly extremely difficult to do. The development of the anchorage basins greatly relieves congestion in the lower part of the harbor, due to the anchoring of small pleasure craft and oyster schooners in that portion of the harbor.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

On June 30, 1909, a low-water draft of 9 feet could be carried over the bar and up as far as Merwin's wharf, thence 6 feet draft to a point about 500 feet above the town dock, and thence draft of about 2½ feet can be carried to the Straw Works dock. No navigation is practicable above this dock.

The commerce of this harbor consists almost entirely of oysters, shells, coal, and fertilizer, the former predominating. The reported tonnage for the calendar year 1908 amounted to 28,587 tons, valued at $411,533.22.

July 1, 1908, balance unexpended	$1,329.28
June 30, 1909, amount expended during fiscal year for maintenance of improvement	2.74
July 1, 1909, balance unexpended	1,326.54
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix D 10.)

11. Housatonic River, Connecticut.—This is a rapid river running southward through Massachusetts and Connecticut, emptying into Long Island Sound east of Stratford Point, about 5 miles east from Bridgeport Harbor. At Derby, 13 miles from its mouth, it receives the discharge of the Naugatuck River. Derby and Shelton are at the head of navigation. About a mile above there is a large power dam across the Housatonic River; above the pool of this dam the river is rocky and shoal.

The original depth on the worst bars in the river (6 in number) was from 3.5 to 4.5 feet. There was also a bar across the river mouth, with about 4 feet depth.

The original project for improvement, adopted under the act of March 3, 1871, provided for a jetty at Sow and Pigs reef; removing Drews rock; a breakwater at the mouth of the river, and making a channel 7 feet deep, 200 feet wide through the bar at the mouth and 150 feet wide in the river, at total estimated cost of $404,961. In 1887 the estimates were revised, and a modification of the project proposed a breakwater or jetty at the mouth of the river 5,750 feet long, extending about south-southeast from Milford Beach 3,250 feet; thence parallel to and 500 feet from the channel 2,500 feet farther, to the 12-foot curve in Long Island Sound, the inner arm of the jetty to be 3 feet above mean low water, top width 6 feet, side slopes 1 on 1; the outer arm to be 6 feet above high water, top width 12 feet, outer slope 1 on 2, inner slope 1 on 1; and a channel 7 feet deep, 200 feet wide at the outer bar, and 100 feet wide through the river, at a total estimated cost of $202,000, and $4,000 annually for maintenance, all in addition to amount already expended. This modification was adopted under the act of August 11, 1888, and work on the breakwater was begun July 10, 1889. In 1893 the project was further modified to provide for building a small dike in the river below Stratford.

For maps see Annual Report of the Chief of Engineers for 1882, page 616, and for reports on various surveys and projects see Annual Reports of the Chief of Engineers for 1871, page 781; 1887, Part 1, page 607; 1888, Part 1, page 554.

The present project for improvement is the project of 1871, subsequently enlarged or modified as above, and the estimated cost from the beginning is $275,500.

Up to June 30, 1909, $272,450 had been expended on this project, of which $73,751.03 had been applied to maintenance. At that date the project was completed, except that the dike below Stratford was not built to the full projected length and the outer arm of the breakwater was only about 4 feet high above high water, 5 feet wide on top, and the side slopes much steeper than called for by the project. A channel of project dimensions had been dredged from the mouth of the river to Derby, but had deteriorated from the action of spring freshets and been redredged from time to time.

On June 30, 1909, 7 feet draft at mean low water could be carried across the outer bar and thence to Derby. The mean rise of tide at Derby is 4.2 and at the mouth of the river about 6.3 feet. The work done has enabled vessels to enter the lower river in safety instead of waiting for high tide in an exposed situation outside. A large part of the commerce could not have been carried on without the improved channel. The navigable channel to Derby materially reduces freight rates at that and adjacent towns, as otherwise all freight would have to be handled by rail and with no competition.

The commerce is largely in coal. A considerable quantity of oyster shells is shipped from near the mouth of the river. The reported tonnage for the calendar year 1908 was 77,895, valued at $378,980.52.

The available balance and the appropriation asked for will be applied to redredging at the bar channels, where needed, and in continuing work on the breakwater.

July 1, 1908, balance unexpended		$9,976.78
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		14,976.78
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$9,501.33	
For maintenance of improvement	475.45	
		9,976.78
July 1, 1909, balance unexpended		5,000.00
July 1, 1909, outstanding liabilities		1.65
July 1, 1909, balance available		4,998.35
July 1, 1909, amount covered by uncompleted contracts		4,900.00
Amount (estimated) required for completion of existing project		76,325.58
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		45,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix D 11.)

12. Bridgeport Harbor, Connecticut.—This consists of a shallow bay, about 1 mile wide at the mouth and 1½ miles long, into the extreme northwest corner of which empties the Poquonock River, a small tidal stream navigable for about 1 mile, and into the northeast corner another small stream about three-fourths of a mile long, known as Johnsons River. Midway between these two streams is Yellow

Mill pond, a tidal basin about 1 mile in length. Black Rock Harbor, now considered part of Bridgeport Harbor, lies about 2¼ miles to the westward. Both harbors are inner portions of a large bay of Long Island Sound lying between the eastern part of Stratford Point and Fairfield reef. Black Rock Harbor is about one-half mile wide at the mouth and 1 mile long, with two branches at its head, the east one a mile long, known as Cedar Creek, and the west one about three-fourths of a mile long, known as Burr Creek.

The original low-water depths were as follows: On the bar at the mouth of Bridgeport Harbor, about 5 feet; in the Poquonock River, from 2 to 5 feet; in Johnsons River, nearly bare in upper half; Yellow Mill pond, generally bare; in Cedar Creek, 2 to 4 feet; and in Burr Creek, nearly bare.

Congress appropriated $10,000 in 1836 and an equal amount in 1852 for improving the main Bridgeport Harbor. These sums were expended in dredging near the mouth of the harbor, making channels 60 to 100 feet wide and 8 feet deep or more at low tide. The depth did not prove permanent. In 1871 and at various times thereafter the original project was enlarged to afford a 15-foot main-harbor channel, a 12-foot channel 200 feet wide in Yellow Mill pond to Stratford avenue, a 9-foot Poquonock River channel, a 12-foot anchorage, and to protect the harbor entrance by two breakwaters, all estimated to cost $285,000. This project was completed in 1898, except as to capacity of the 15-foot channel.

The amount expended on the projects above named was $317,848.50.

At Black Rock Harbor, between 1836 and 1838, $21,550 was expended in building a sea wall across a breach in the southern part of Fayerweather Island. In 1884 a project was adopted for protecting the upper part of Black Rock Harbor by a breakwater about one-half mile long between Fayerweather Island and the mainland and for making a 6-foot channel 80 feet wide in Cedar Creek. The channel had been made, the breakwater built to full length, but with reduced cross section, and the project was considered as completed July 1, 1894. Subsequently repairs were made on the old sea wall on Fayerweather Island. The amount expended for Black Rock Harbor as a separate improvement was $72,900.

For details of original projects and their modifications see Annual Reports of the Chief of Engineers, 1902, pages 133 and 134, and 1903, pages 116 and 117.

In the act of March 3, 1899, Congress adopted a project for Bridgeport Harbor which provided, at an estimated cost of not exceeding $300,000, for—

First. The main channel, 18 feet deep, 300 feet wide from the outer bar to the inner beacon, thence 200 feet wide to the lower or Stratford Avenue Bridge across the Poquonock River.

Second. Three anchorage basins: One 18 feet deep, 500 feet wide, and 2,000 feet long adjoining the main channel on the west above the inner beacon; one 12 feet deep, 500 feet wide, and 900 feet long adjoining the main channel on the west between the 18-foot anchorage and Naugatuck wharf, and one 12 feet deep at east side of channel between the steel works point and the lower bridge.

Third. Poquonock River channel, from the lower bridge to the head of navigation, about 1 mile, 12 feet deep and 100 feet wide.

Fourth. Yellow Mill channel, from the main channel to the head of Yellow Mill pond, about 1 mile, 12 feet deep and 100 feet wide.

Fifth. Johnsons River channel, from the main channel to the head of navigation, about 1¼ miles, 9 feet deep and 100 feet wide.

Sixth. Black Rock channel, from the head of Black Rock Harbor to the junction of Cedar and Burr creeks, thence up each of these creeks to the head of navigation, with lengths, respectively, of 1½ miles and one-half mile, 9 feet deep and 100 feet wide.

Seventh. The repair and maintenance of the outer and inner breakwaters of the main channel, and the one connecting Fayerweather Island with the mainland as now built, and the construction and maintenance of shore protection on Fayerweather Island to check the shifting of the beach.

An appropriation of $50,000 was made in the act cited and a continuing contract authorized, under which work was begun July 9, 1900, and carried on, with many interruptions and delays, until January 1, 1906, at which time the contract was 61 per cent completed. On account of the unsatisfactory progress this contract was annulled May 10, 1906, and the work relet. Work under the new contract was commenced July 25, 1906, and completed May 17, 1907, completing the project as authorized in 1899, except a section of Burr Creek, the inner end of Yellow Mill channel, and the inner end of Johnsons River, where, on account of ledge rock, the full project dimensions of the channels were not obtained.

The amount expended on this project to June 30, 1909, was $233,912.50, of which $33,026.91 was applied to maintenance, making the total expended on all projects prior to that now existing $624,661.

The act of March 2, 1907, authorized the extension of the project to include an anchorage basin 22 feet deep, 1,280,000 square feet in area opposite the inner breakwater, deepening the main entrance channel to 22 feet as far as the inner end of the 22-foot anchorage basin, an additional 12-foot anchorage basin 608,600 square feet in area northwest of the 22-foot basin, and two breakwaters for the protection of the deep anchorage basin, at an estimated cost of $463,000. The act appropriated $113,000, and authorized continuing contracts in the additional sum of $350,000 for completing the work authorized. Of this amount $210,000 is yet to be appropriated.

Reports of examination and survey containing the enlarged project are printed in House Documents Nos. 275 and 521, Fifty-ninth Congress, second session.

Contracts for the completion of the work authorized by the act of March 2, 1907, have been made. The breakwaters and the 12-foot anchorage basin have been completed and the deepening of the main channel commenced.

The amount expended on the project of 1907 to June 30, 1909, was $131,067.78, of which $2,943.64 was applied to maintenance.

The maximum draft that could be carried June 30, 1908, through the improved channels at mean low tide is about 18 feet through the main channel from the outer end to the lower bridge; in the Poquonock River, about 11 feet; in the Yellow Mill channel, 12 feet; in Johnsons River, 9 feet; at Black Rock, 9 feet to the head of navigation in both branches of Cedar Creek; in Burr Creek, about 7 feet to its head. The mean rise of tide is 6.5 feet.

The balance on hand and additional appropriations will be applied to completing the project and to maintenance.

The work done has greatly facilitated the navigation of the harbor and made the present commerce possible and materially reduced freight rates.

The commerce of this harbor is chiefly in coal, lumber, iron, building material, petroleum products, oysters, and general merchandise. Tonnage reported for calendar year 1908 was 890,895 tons, valued at $37,572,196.20.

July 1, 1908, balance unexpended		$107, 108. 13
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10, 000. 00
Amount appropriated by sundry civil act approved March 4, 1909		100, 000. 00
		217, 108. 13
June 30, 1909, amount expended during fiscal year:		
Deposited with Treasurer of United States	$218. 04	
For works of improvement	73, 493. 27	
For maintenance of improvement	2, 943. 64	
		76, 654. 95
July 1, 1909, balance unexpended		140, 453. 18
July 1, 1909, outstanding liabilities		11, 503. 01
July 1, 1909, balance available		128, 950. 17
July 1, 1909, amount covered by uncompleted contracts		107, 709. 62
Amount (estimated) required for completion of existing project		210, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		20, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix D 12.)

13. Norwalk Harbor, Connecticut.—This harbor consists of the tidal part of Norwalk River extending from Norwalk, the head of navigation, to the river mouth, about 3 miles, and of an outer or main harbor lying between Norwalk Islands and the mainland. South Norwalk is on the west bank, about 1½ miles below Norwalk. The original depth in the river up to South Norwalk was about 5 feet; between there and Norwalk the river bed was nearly bare at low tide.

The sum of $80 was expended in the year 1829 in making a survey of the harbor in accordance with the act of Congress approved March 2 of that year.

The original project, adopted under the act of June 10, 1872, and modified by the terms of the act of June 14, 1880, provided for a channel 100 feet wide and 8 feet deep from the outer harbor to South Norwalk, and thence 6 feet deep to Norwalk. This project was considered completed in 1892 at a cost of $83,000, although portions of the channel between Norwalk and South Norwalk were only 60 feet wide. The act of August 18, 1894, appropriated $15,000 for improving the inner harbor, and indicated the points where work was to be done. In accordance therewith a project was adopted for removing to 6 feet depth the shoal at Ferrys Point, below Norwalk, and, if funds permitted, for widening with depth of 9 feet the bend at Keysers Island, near the river mouth. This project was completed in 1897 at a cost of $15,000. A project adopted by the act of June 3, 1896, provided for a channel 10 feet deep and 150 feet wide from the outer harbor to South Norwalk, widening two points near the entrance, and the maintenance of this channel and the 6-foot channel between South Norwalk and Norwalk, at estimated first cost of $62,000, and $2,000 annually for maintenance. This project was completed October 3, 1905; the amount expended on it was $36,833, of which $15,516.89 was expended for maintenance.

The present project, adopted by the act of March 2, 1907, provides for the restoration of the channel 10 feet deep and 150 feet wide to South Norwalk, for a channel 8 feet deep of a general width of 100 feet from South Norwalk to Norwalk, and for a channel 6 feet deep, 2,900 feet long, of a general width of 75 feet, to the docks at East Norwalk, and for maintenance of these channels, at an estimated first cost of $65,500, and $8,000 per annum for maintenance.

Channels of the full dimensions called for by this project were completed September 19, 1908. The amount expended on this project to June 30, 1909, was $52,963.43, of which $8,858.41 was expended for maintenance.

The maximum draft that could be carried at low water June 30, 1909, to the South Norwalk docks was 10 feet, to the Norwalk docks 8 feet, and to the East Norwalk docks 6 feet. The mean rise of tide is 7.1 feet.

For reference to reports and maps regarding this harbor and former projects, see Annual Report of the Chief of Engineers for 1904, page 103. For present project, see House Document No. 262, Fifty-ninth Congress, second session.

The available balance and the appropriation asked for will be applied to maintenance of the improvements.

The commerce of this harbor is mainly in coal, oysters, lumber, wood pulp, building material, and general merchandise, and on all these items the improvement has effected a material reduction in freight rates. The reported tonnage for calendar year 1908 amounted to 199,465 tons, valued at $19,359,751.28.

July 1, 1908, balance unexpended		$36,268.99
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$25,236.09	
For maintenance of improvement	496.33	
		25,732.42
July 1, 1909, balance unexpended		10,536.57
July 1, 1909, outstanding liabilities		21.52
July 1, 1909, balance available		10,515.05
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		8,000.00

(See Appendix D 13.)

14. Harbors at Fivemile River, Stamford, Southport, Greenwich, and Westport, and Saugatuck River, Connecticut.—(a) *Fivemile River Harbor.*—This is a tidal inlet about 1 mile long and from 100 to 1,000 feet wide. The natural low-water depth at the mouth was about 3 feet, shoaling to zero about halfway up the harbor and to about plus 2.5 feet at extreme head. The original and present project of improvement, adopted under authority of the act of August 11, 1888, provides for a dredged channel 8 feet deep and 100 feet wide, extending up the harbor about 6,000 feet from its mouth. The estimated cost from the beginning, as revised in 1894, was $45,000.

For further details regarding this harbor, see page 192, Annual Report of the Chief of Engineers, 1901.

Up to June 30, 1909, $39,790.44 had been expended on this project, of which $4,300 had been for maintenance. At that date a channel of project dimensions had been dredged about 5,400 feet up the harbor and thence about 200 feet farther with project depth and widths of 25 to 75 feet. No dredging has been done above this point. About 82 per cent of the project is completed.

The maximum draft that could be carried to the upper end of the improved channel is 7 feet, and no navigation is possible beyond this point except at high tide, when a draft of from 4 to 4½ feet can be carried about 1,400 feet farther to the head of navigation. The mean rise of tide is 7.2 feet.

The future appropriations will be applied toward maintenance and completion of the project by widening the channel to project dimensions and extending it upstream as funds permit.

The commerce of this harbor is mainly confined to the oyster industry, which could not be carried on to its present extent without the improved channel. Traffic reported for calendar year 1908 amounted to 21,986 tons, valued at $353,009.50.

July 1, 1908, balance unexpended		$210.06
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$0.50	
Amount transferred to Stamford Harbor	209.56	
		210.06
Amount (estimated) required for completion of existing project		9,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a]

(*b*) *Stamford Harbor.*—This consists of a bay on the north shore of Long Island Sound and of two tidal inlets known as the east and west branches, extending to the head of navigation at the city of Stamford. The original depth in the west branch was from 1 foot to 3 feet, gradually increasing in the bay to a depth of 12 feet. The east branch was originally a small marshy creek, deepened by private dredging to a depth of about 8 feet and which had shoaled so that when work was begun by the Government in 1892 the available depth was only about 6½ feet.

The original project, adopted under authority of the river and harbor act of 1886, was for a 5-foot channel 80 feet wide to the head of the west branch. This was considered completed in 1892 after an expenditure of $20,000, the channel being 5 feet deep and 100 to 140 feet wide at the bends, but only from 50 to 70 feet wide for the last thousand feet at the upper end.

---

[a] See consolidated money statement on page 123.

The present project, adopted under authority of the act of July 13, 1892, provides for a channel in the west branch 7 feet deep, 150 feet wide, and about 1⅛ miles long, with a basin of same depth between harbor lines at the head of the harbor, and in the east branch, as approved October 5, 1892, a channel 9 feet deep and 100 feet wide for a length of about 8,535 feet and 50 feet wide for about 1,200 feet farther to the head of the harbor. The estimated cost was $123,500. A modification to give increased width at upper end of east branch was approved February 12, 1901.

For reports on surveys and projects, see Annual Report of the Chief of Engineers, 1884, Part 1, page 672; 1891, Part 1, page 849; 1893, page 954 (map, p. 956).

Up to June 30, 1909, $128,260.53 had been expended on this project, of which $32,511 had been for maintenance. At that date the channel in the east branch had been completed to full project dimensions; the channel in the west branch had been dredged to project dimensions from its outer end to the south end of the basin; a portion of the south end of the basin completed and a channel with a general width of 125 feet dredged along both sides and across the upper end of the basin. The available depth which could be carried June 30, 1909, to the extreme head of the west branch was 7 feet and 9 feet through the east branch channel to its head. The mean rise of tide is 7.4 feet.

The appropriation asked for will be applied toward maintenance and completion of the project.

The commerce of this harbor consists mainly of coal, lumber, stone, sand, clay, ores, and steamboat freight. The reported tonnage for calendar year 1908 amounted to 343,810 tons, valued at $10,439,840.34. The improvements made have rendered it possible for the steamers to run on schedule time and to enter the harbor at any stage of the tide, which they were unable to do previously, and have materially reduced freight rates.

July 1, 1908, balance unexpended		$12,087.01
Amount transferred from Fivemile (River Harbor)	$209.56	
Amount transferred from Greenwich Harbor	939.97	
		1,149.53
		13,236.54
June 30, 1909, amount expended during fiscal year, for works of improvement		13,236.54
Amount (estimated) required for completion of existing project		28,900.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a]

(*c*) *Southport Harbor.*—This is a tidal part of Mill River at town of Southport, about 1 mile long and averaging less than 100 yards wide. The original depth was probably less than 2 feet at the entrance to the harbor, shoaling to about plus 1 foot at the upper end. Work was begun in this harbor by the Government in 1829 and prosecuted with various intermissions until 1878. During this time a dike inside and breakwater or jetty outside were built, and a channel 60 feet wide and 4 feet deep dredged across the outer bar. In 1878 a project was adopted for dredging a channel 100 feet wide and 4 feet deep across the bar and upstream 1,200 feet from the outer end of the jetty, and thence in a bifurcated channel to the nearest docks. In 1882 this project was reported as substantially completed, $31,587.23 having been spent since the beginning of work in 1829.

---

[a] See consolidated money statement on page 123.

The present project, adopted by act of June 13, 1902, is to dredge a channel 6 feet deep through the outer bar to the upper docks 100 feet wide to the turn above White Rock, and thence in two branches, each 60 feet wide; to repair the breakwater and to remove two points of ledge from the channel to a depth of 7 feet. The original estimated first cost of this improvement was $13,200, and for yearly maintenance $300, to be expended biennially, but on account of the development of two additional outcroppings of ledge during the dredging it became evident that this estimate would be greatly exceeded before the work could be completed, and in 1906 the estimated cost was increased to $15,111 for this work.

For further details regarding this harbor and its former projects, see Annual Report of the Chief of Engineers, 1897, page 986.

Up to June 30, 1909, $20,348.51 had been expended on this project, of which $1,677.53 had been for maintenance. At that date a channel of project depth and 75 to 100 feet width had been dredged to the turn above White Rock, and thence with full depth and widths of 40 to 60 feet up the east branch and along the dock front for about 200 feet; two points of ledge rock had been removed, and the breakwater repaired. About 65 per cent of the project is completed.

The maximum draft that can be carried through the improved portion of the channel is 6 feet. Above this point, where no dredging has been done, a draft of 3 to 4½ feet can be carried to the upper docks at low tide. Above the upper end of the projected channels the harbor is navigable only at high tide and for a distance of about half a mile. The mean rise of tide is 6.6 feet.

The improved channel permits vessels of not exceeding 6 feet draft to enter the harbor without being compelled to wait outside the bar in an exposed situation for the tide to rise.

The appropriation asked for will be applied toward maintenance and completing the project.

The commerce of this harbor consists mainly of farm produce, general merchandise, oysters, and coal. The reported tonnage for calendar year 1908 amounted to 6,821, valued at $66,060.

The effect of the improvement on freight rates, if any, is not known.

July 1, 1908, balance unexpended		$1,942.09
Amount transferred from Greenwich Harbor		459.51
		2,401.60
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,100.50	
For maintenance of improvement	301.10	
		2,401.60
Amount (estimated) required for completion of existing project		13,111.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

---

[a] See consolidated money statement on page 123.

(*d*) *Greenwich Harbor.*—This is a shallow bay about 2 miles east from the New York state line, extending about a mile northward from Long Island Sound. The original low-water depth was about 6 feet to the lower docks. Above this point it shoaled rapidly to 3 feet 1,000 feet above and to about plus 2 at the head of the harbor. The original and present project, adopted in the act of June 3, 1896, is to dredge a channel 90 feet wide from the mouth of the harbor to the causeway at its head, a distance of about a mile, to be 9 feet deep to the steamboat dock and 6 feet deep above, the upper end to be enlarged to form a turning basin. The estimated first cost was $20,000. Page 860, Annual Report of the Chief of Engineers, 1895, gives report of examination upon which the project is based. Up to June 30, 1909, $21,090.60 had been expended on this project, of which $4,073.41 had been for maintenance.

This project was completed September 23, 1905. The work done has enabled vessels to enter the harbor with 9 feet draft at low tide, thus permitting the regular steamer to make trips without waiting for tide. Above the steamboat dock a draft of 6 feet can be carried at low tide to the head of navigation. The mean rise of tide is 7.5 feet.

Map of survey made in June, 1908, with reference to need of maintenance and the location and identification of harbor lines was completed during the fiscal year.

The appropriation asked for will be applied to maintenance of the improvement.

The commerce of this harbor consists mainly of coal, lumber, building material, and general merchandise. The reported tonnage for calendar year 1908 amounted to 76,160, valued at $9,778,000.

The effect of the improvement on freight rates, if any, is not known.

July 1, 1908, balance unexpended			$2,188.82
June 30, 1909, amount expended during fiscal year for maintenance of improvement		$512.42	
Amount transferred to—			
Stamford Harbor	$939.97		
Southport Harbor	459.51		
Westport Harbor	270.99		
		1,670.47	
			2,182.89
July 1, 1909, balance unexpended			5.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909			(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.			

(*e*) *Westport Harbor and Saugatuck River, Connecticut.*—For description of these localities and statement of work under original project of 1826, and its modifications to about 1871, see Annual Report of the Chief of Engineers for 1901, page 189. The total amount expended for the same is $19,444.

The present project, adopted in 1892, originally provided for a channel 4 feet deep and 60 feet wide up to Westport, at an estimated cost of $10,000.

---

[a] See consolidated money statement on page 123.

As a result of a survey authorized by the act of August 18, 1894, the project was modified in 1896 to provide for repairing the Cedar Point breakwater, removing a ledge opposite Stony Point, or dredging around it, and removing bowlders from the channel, at an estimated cost of $8,000, and the total estimated cost was in consequence increased to $18,000.

A sketch of this river and harbor is printed in the Annual Report of the Chief of Engineers for 1894, page 670, and report of the survey authorized in 1894 is printed in the Annual Report of the Chief of Engineers for 1896 and, with map, in House Document No. 67, Fifty-fourth Congress, first session.

The total amount expended on the present project up to the close of the fiscal year ending June 30, 1909, was $15,270.99, of which $109.44 was for maintenance. The 4-foot channel had been completed to Westport, head of navigation, with width generally of 60 feet, the ledge opposite Stony Point removed, and the Cedar Point breakwater repaired and extended. About 70 per cent of the project is completed. The mean rise of tide is about 7 feet.

Completion of the project requires further removal of bowlders and dredging to full project dimensions at the channel opposite Westport. Improvements made have rendered navigation of the river practicable at less than half-tide stages by vessels plying there.

Future appropriations will be applied to maintenance and the completion of the project.

The commerce comprises coal, lumber, farm produce, and steamboat freight. The reported tonnage for calendar year 1908 was 11,504, valued at $43,655.

The effect of the improvement on freight rates, if any, is not known.

July 1, 1908, balance unexpended		$1,849.22
Amount transferred from Greenwich Harbor		270.99
		2,120.21
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,107.69	
For maintenance of improvement	12.52	
		2,120.21
Amount (estimated) required for completion of exising project		3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance		([a])

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

CONSOLIDATED.

July 1, 1908, balance unexpended		$18,277.20
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$17,445.23	
For maintenance of improvement	826.04	
		18,271.27
July 1, 1909, balance unexpended		5.93
Amount (estimated) required for completion of existing project		54,311.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		48,411.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix D 14.)

---

[a] See consolidated money statement on this page.

15. *Removing sunken vessels or craft obstructing or endangering navigation— Wreck of Schooner Menawa.*—This vessel, loaded with lath, was in collision on July 18, 1908, with U. S. S. *Mayflower* and seriously damaged. On July 27 the schooner was towed into New Haven harbor by the U. S. tug *Apachee* and left in a position dangerous to navigation. Circular proposals were issued for the removal of the wreck, the bid of Reed & Farrar, $376, accepted. A portion of the cargo was recovered and the removal of the wreck completed in October, 1908.

Wreck of lighter, name unknown.—This vessel, originally a wooden sloop about 70 feet long, was abandoned about six years ago and left on the mud flats on the west bank of the Poquonock River, Bridgeport Harbor. The hulk gradually slid out to a point where it became an obstruction to navigation. Proposals for the removal of the wreck were issued in April, 1909, the bid of the T. A. Scott Company (Incorporated), $290, accepted, and the wreck entirely removed in May, 1909.

(See Appendix D 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST NEW YORK, NEW YORK, DISTRICT.

This district was in the charge of Col. John G. D. Knight, Corps of Engineers, to January 15, 1909, in the temporary charge of Col. D. W. Lockwood, Corps of Engineers, from January 15 to February 19, 1909, and in the charge of Col. W. M. Black, Corps of Engineers, since the latter date. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. *Port Chester Harbor, New York.*—This harbor, situated at the boundary between the States of New York and Connecticut, consists of the tidal part of Byram River and of a bay at its mouth opening into Long Island Sound. The depth in the river before improvement was 1 foot, and Salt rock, in the river, and Sunken rock, in the bay, were considered to be dangerous obstructions.

The original project for this improvement was adopted in 1872 and modified in 1884 and 1888. It proposed to remove Salt rock to 9 feet below mean low water, to build a breakwater from Sunken rock to Byram Point, and to dredge and maintain a channel to the Port Chester wharves, at a total cost of $57,000. Up to 1899, at a total cost of $52,000, this project had been completed, except the dredging in the upper harbor.

The existing project, approved March 3, 1899, provides for a channel 12 feet deep at mean low water and 70 feet wide from deep water in the bay up to the town wharf, at Fox Island, and thence 9 feet deep and 60 feet wide to the steamboat wharf, the work to be done by dredging and rock removal. Estimated cost, $25,000. By act of 1907 the project was extended to include removal of ledges of rock opposite the southerly point of Fox Island.

Up to June 30, 1909, $34,348.95 had been expended on the present project; of this amount $11,348.95 was for maintenance. There was received from sale of maps $0.75.

Expenditures during the year were for surveys and office expenses.

About 92 per cent of the work proposed under the present project has been completed and has resulted in making a channel of the projected width and depth, except at and above Fox Island, where the width is reduced by ledges of rock the removal of which it is estimated will cost $15,750. A project for the further improvement of the harbor is printed in House Document No. 1165, Sixtieth Congress, second session. Should this project be adopted, the removal of these ledges under the present project will be unnecessary. Consequently no fiscal year estimate is submitted for continuing work on the existing project, pending action by Congress on the new plan of improvement now before it for consideration.

The dredged channel has shoaled to a considerable extent.

The available funds and the additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried June 30, 1909, at mean low water is estimated at 10½ feet up to the town wharf; thence 5½ feet to the steamboat wharf, and above the steamboat wharf 2 feet. Mean range of tides 7.4 feet. The head of navigation is at a fixed bridge at Mill street, about 900 feet above the steamboat dock. The total length of navigable channel from Long Island Sound to the bridge is about 1½ miles.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, manufactured goods, and farm produce, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	140,000	$4,936,000	1904	255,000	$4,590,000
1899	169,500	6,256.000	1905	293,000	7,365,000
1900	181.000	7,269.500	1906	265,000	6,870,000
1901	327,500	9,118.000	1907	275,000	7,405,000
1902	237,000	900,000(?)	1908	265,000	7,355,000
1903	240,000	3,940,000			

The commerce of this harbor has increased with the improvement. So far as has been ascertained, the improvement of this harbor has brought about a reduction in freight rates.

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1897, page 1084, and 1900, page 1378. Sketches of the river and harbor are printed in Reports of the Chief of Engineers for 1885, page 658, and for 1889, page 716.

Report upon examination and survey of Port Chester Harbor, made in 1907–1908, and map of the locality are printed in House Document No. 1165, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$5,611.82
Received from sales	.75
	5,612.57
June 30, 1909, amount expended during fiscal year for maintenance of improvement	460.77
July 1, 1909, balance unexpended	5,151.80
July 1, 1909, outstanding liabilities	28.00
July 1, 1909, balance available	5,123.80
Amount (estimated) required for completion of existing project	15,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E 1.)

2. *Mamaroneck Harbor, New York.*—This harbor, situated on the north shore of Long Island Sound, consists of a narrow inlet opening into a shallow broad bay. Before improvement, the channel to the old steamboat wharf, half a mile up the inlet, had a depth of 5 feet at mean low water, gradually decreasing to 1 foot at the upper wharves. Various rocks at or near the mouth of the inlet obstructed navigation.

The present project, approved August 2, 1882, and modified April 27, 1899, provides for the removal of Round rock to a depth of 4 feet and Bush rock and Inner Steamboat rock to a depth of 7 feet at mean low water, and for making a channel 7 feet deep at mean low water and 100 feet wide from the harbor entrance to the upper wharves. Estimated cost, $43,000.

Up to June 30, 1909, $40,000 had been expended on this work; of this amount $4,628.50 was for maintenance.

About 82 per cent of the work proposed under the project has been completed, and has resulted in making a channel with a uniform depth of 7 feet at mean low water and a width of from 70 to 100 feet from the harbor entrance to the turn at Hog Island, and thence 100 feet wide to the upper wharves. The channel has probably deteriorated to a considerable extent.

The appropriation recommended is to be applied toward completing the improvement and to maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water is probably less than 7 feet. Mean range of tides, 8 feet. The head of navigation is at a fixed bridge just above the upper wharves. The total length of navigable channel from Long Island Sound is about 1 mile.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, and manufactured goods, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1896	29,095	$482,692	1904	49,589	$859,242
1897	51,673	877,180	1905	54,944	201,398(?)
1901	20,705	51,598(?)	1906	15,756	131,000
1902	48,495	75,000(?)	1908	38,540	1,620,225
1903	26,230	337,000			

It is not known that freight rates have been affected by this improvement, but it has facilitated the transportation, especially of coal and building materials.

Detailed description of this improvement can be found in Report of the Chief of Engineers for 1900, page 1381. Sketch of harbor is printed in Report of the Chief of Engineers for 1903, page 859.

Amount (estimated) required for completion of existing project........... $7,628.50

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance................ 6,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix E 2.)

3. Larchmont Harbor, New York.—This harbor, situated on the northwest shore of Long Island Sound, 4 miles distant from New York City limits, is about half a mile wide and five-eighths of a mile long. It is exposed to easterly and southerly storms. Two submerged rocks (Umbrella rock and Huron rock) formerly obstructed the entrance, which has a depth of 18 feet, gradually dimishing toward the head of the bay.

The original project for this improvement, adopted September 19, 1890, provided for building two breakwaters to protect the anchorage ground, one to extend from Umbrella rock to Umbrella Point and the other from Huron rock to Long Beach Point, at an estimated cost of $105,000. Work under this project was suspended in 1891 after the first appropriation of $5,000 had been expended in commencing the two breakwaters.

The present project, adopted March 3, 1899, provides for building a breakwater extending southwardly 1,440 feet from the 6-foot curve off Long Beach Point and for the removal of Huron rock to a depth of 14 feet at mean low water. Estimated cost, $108,000. The project was extended by act of 1907 to include removal of ledges adjoining Huron rock.

To June 30, 1909, $65,666.16 had been expended on the existing project, all for improvement.

There were no operations during the year, the disbursements having been in part payment of office expenses and of the cost of a sounding, boring, and sweeping scow.

About 60 per cent of the work proposed under the present project has been completed, and as a result the breakwater has been built to full projected section to a length of 1,410 feet, and Huron rock and a portion of the adjoining ledge removed to depths of 14 and 12 feet, respectively.

The available funds are sufficient for completing the improvement and will be applied to this purpose and for maintenance.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the entrance channel at mean low water is estimated at 18 feet. The general depth of the anchorage area of the harbor is from 6 to 12 feet at mean low water. Mean range of tides, 7.4 feet. The harbor is about half a mile wide and extends rather more than half a mile inland. It is a basin with no definite channel.

The harbor has but little commerce. It is mainly used by the Larchmont Yacht Club, by coasting and fishing vessels for night anchorage, and as a harbor of refuge.

Local freight rates are thought not to have been affected by the improvement.

Detailed description of this improvement is printed in Report of the Chief of Engineers for 1900, page 1383. A sketch of the harbor is printed in Report of the Chief of Engineers for 1903, page 860.

July 1, 1908, balance unexpended	$21,377.02
June 30, 1909, amount expended during fiscal year, for works of improvement	1,138.14
July 1, 1909, balance unexpended	20,238.88

(See Appendix E 3.)

4. Harbor at Echo Bay, New York.—This harbor is on the north shore of Long Island Sound, 2 miles distant from New York City limits. It is landlocked, except toward the southeast, and has a good anchorage. Nearly all of the water transportation of the town of New Rochelle is carried on through this harbor.

The original project for improvement, adopted in 1875, provided for the removal of two ledges, known as Start rock and Sheepshead reef, to 7 and 9 feet depth at mean low water, respectively, at an estimated cost of $38,955.38.

Prior to 1902 the sum of $22,000 had been appropriated, with which Start rock was reported wholly and Sheepshead reef partly removed to the projected depths, and a channel 40 feet wide and 4 feet deep at mean low water was dredged from Beauford Point to within 300 feet of the head of the harbor.

The project adopted by the river and harbor act of June 13, 1902, contemplated the completion of the original plan by the removal of the remainder of Sheepshead reef and Start rock, at an estimated cost of $17,000. This work was completed September 25, 1903, at a total cost of $8,546.68.

The river and harbor act of March 3, 1905, directed an examination to be made of Long rock, with a view to its removal, and authorized the expenditure of any balance remaining from previous appropriations for this purpose. The removal of such part of the rock to 6 feet below mean low water as the available funds ($8,453.32) would permit was authorized by the Secretary of War August 21, 1906. Of this amount $8,412.92 was expended to June 30, 1908, leaving a balance of $40.40 in addition to the amount appropriated March 2, 1907. As a result of this expenditure the channel at Beauford Point (Hudson Park) was deepened to 6 feet at mean low water with a width of 100 feet.

The present project, adopted March 2, 1907, provides for completing the removal of Long rock, at a total estimated cost of $10,000. Up to June 30, 1909, $8,409.40 had been expended, completing the project, and resulting in the removal of an obstruction which had caused considerable damage to vessels using the channel at Beauford Point.

The available funds are to be applied to maintenance if found necessary.

The maximum draft that could be carried to Beauford Point on June 30, 1909, is estimated at 6 feet at mean low water. The general harbor anchorage ranges from 9 to 18 feet at mean low water. The mean range of tide is about 7½ feet. The head of navigation is at a wharf about 1,500 feet above Beauford Point. The harbor is about one-fourth mile wide and one-third mile long. The total length of navigable channel extending beyond the deep water of the harbor is about one-fifth of a mile.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, and manufactured goods, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1902	99,000	$500,000	1906	270,460	$2,789,208
1903	129,400	1,434,000	1907	269,135	2,545,585
1904	151,200	1,647,500	1908	244,750	2,092,500
1905	193,650	2,071,800			

Commerce has been materially benefited and freight rates have probably been reduced by this improvement.

For detailed description of work see Report of the Chief of Engineers for 1900, page 1429. A sketch of the locality is printed in Report of the Chief of Engineers for 1903, page 862.

Report upon examination and survey of Echo Bay Harbor, and map of the locality are printed in House Document No. 1118, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$12,040.40
June 30, 1909, amount expended during fiscal year for works of improvement	8,409.40
July 1, 1909, balance unexpended	3,631.00

(See Appendix E 4.)

5. *Bronx River and East Chester Creek, New York.—(a) Bronx River.*—This stream empties into a shallow bay three-fourths of a mile long, and seven-eighths of a mile wide, having a navigable channel with low water depth of 3 feet, and which opens into the East River north of Hunts Point. The navigable part extends from its mouth to West Farms, a length of about 2½ miles. At this point it is crossed by a dam. The natural depth at the mouth was 4 feet at mean low water, and decreased ascending the stream to less than 1 foot at the head of navigation.

The project for improvement, adopted by the act of June 3, 1896, provides for making a channel 4 feet deep at mean low water and 100 feet wide from the mouth to Barlow street (now Falconer street); thence to Dongan street (now Garrison avenue) 60 feet wide, and thence to the head of navigation 50 feet wide, the work to be done by dredging and rock removal. Estimated cost $85,985.

Up to June 30, 1909, $67,437.03 had been expended on the project for improvement. There was received from sales of maps $0.65.

About 80 per cent of the work proposed under the present project has been completed and has resulted in a channel from the mouth to the turn east of the gas works with depths of from 3 to 6 feet at mean low water and with a diminishing width of from 100 to 50 feet, except at Westchester avenue where slightly reduced by a ledge of rock. Above this point the channel remains as previously reported. As shown by a recent survey, the dredged channel has deteriorated to a considerable extent.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the channel at mean low water from the mouth to the turn east of the gas works is about 2½ feet; above this point, 1 foot. Mean range of tide is 6.6 feet at mouth and 6 feet at West Farms. The head of navigation is at a dam just beyond the dye works. The total length of navigable channel is about 3 miles.

The tonnage and value of the commerce of this river, mainly in coal, cotton goods, drugs for dying purposes, ice, and building materials, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	139,310	$526,025	1905	181,093	$820,482
1899	171,300	1,985,700	1906	341,538	1,720,097
1902	153,137	500,000	1907	382,957	1,807,317
1903	77,710	536,400	1908	401,433	2,017,560
1904	42,286	196,642			

The river has an extensive and growing commerce as shown above. This commerce is mainly carried on barges of from 20 to 35 feet width, towed by tugs. Just complaint is made of the interruptions and delays to traffic owing to the impossibility of tows passing each other in the narrow channel and at points of even passing a barge moored to a wharf. Due to the slight depth found, all movement of vessels must be made at high-water stages.

Details of improvement can be found in Report of the Chief of Engineers for 1897, page 1093, and for 1900, page 1389. A sketch of a part of the stream is printed in Report of the Chief of Engineers for 1904, page 1016.

July 1, 1908, balance unexpended	$41,548.63
June 30, 1909, amount expended during fiscal year, for works of improvement	29,485.01
July 1, 1909, balance unexpended	12,063.62
July 1, 1909, outstanding liabilities	172.77
July 1, 1909, balance available	11,890.85
Amount (estimated) required for completion of existing project	6,485.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	([a])

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*b*) *East Chester Creek.*—This is a small tidal stream emptying into East Chester Bay. It was originally navigable at high tide for vessels drawing 7 feet as far as Lockwoods, a distance of 2¼ miles.

The project for improvement, adopted March 3, 1873, provided for a channel 100 feet wide and 9 feet deep, mean high water, from deep water in East Chester Bay to a point 3,000 feet above Lockwoods. Estimated cost, $136,500; subsequently reduced to $124,000, as modified in 1891.

Up to June 30, 1909, $115,500 had been expended on the project; of this amount $25,408.78 was for maintenance. There was received from the sale of maps $2.

The project has been completed and has resulted in making a channel 9 feet deep at mean high water and 100 feet wide from East Chester Bay to Town dock; thence to Lockwoods somewhat less than 100 feet wide; and thence to a point 3,000 feet above Lockwoods, 100 feet wide. The channel above Lockwoods had deteriorated to such extent that the expenditure under the last appropriation resulted in restoring only about 75 feet in width in this section of the creek to its projected depth. Considerable shoaling has also occurred in the channel below Lockwoods.

---

[a] See consolidated money statement on page 131.

The appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried over the shoalest part of the channel on June 30, 1909, is estimated at 9 feet at mean high water in mid-channel. Mean range of tides is 7.1 feet. The head of navigation is at the upper end of the artificial channel. The total length of navigable channel is about 2¾ miles.

The tonnage and value of the commerce of this creek, mainly in coal, building material, and miscellaneous freight, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1896	94,928	$2,199,186	1905	206,275	$1,755,850
1899	286,428	1,957,224	1906	282,655	3,063,360
1902	99,750	870,500	1907	354,019	1,954,254
1903	104,655	572,800	1908	273,369	2,864,000
1904	146,955	963,263			

The effect of this improvement has been to increase the number of firms carrying on business along this stream. So far as has been learned this improvement has made no change in freight rates, but commerce has greatly increased.

For detailed reports see Reports of the Chief of Engineers for 1897, page 1089, and 1904, page 1016. A sketch of the stream is printed in Report of the Chief of Engineers for 1904, page 1016. For references to reports on examinations and surveys, see Report of the Chief of Engineers for 1904, pages 112 and 1061.

Report upon examination and survey of East Chester Creek is printed in House Document No. 1250, Sixtieth Congress, second session.

Received from sales during the year	$2.00
July 1, 1909, balance unexpended	2.00
July 1, 1909, outstanding liabilities	2.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

CONSOLIDATED.

July 1, 1908, balance unexpended	$41,548.63
Received from sales	2.00
	41,550.63
June 30, 1909, amount expended during fiscal year, for works of improvement	29,485.01
July 1, 1909, balance unexpended	12,065.62
July 1, 1909, outstanding liabilities	174.77
July 1, 1909, balance available	11,890.85
Amount (estimated) required for completion of existing project	6,485.00

---

[a] See consolidated money statement on this page.

Amount that can be profitably expended in the fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	$26,485.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E 5.)

6. Harbors at Port Jefferson, Mattituck, Huntington, Glencove, Flushing Bay, and Canarsie Bay, New York.—(a) Port Jefferson Harbor.—This is a large and deep inland bay, situated on the north shore of Long Island, and connected with Long Island Sound by a narrow entrance.

Before improvement the channel depth outside the entrance was but 4 feet at mean low water, whereas the depth in the harbor was 12 feet and more, at low tide, up to within 300 feet of the wharves of Port Jefferson village.

The first project for improvement was adopted in 1871, and completed in 1883, at a total cost of $79,000. Two jetties were built to shelter the inlet channel, one east of the inlet, 1,390 feet long, and one west, 940 feet long, both of scant cross section. A channel 8 feet deep at mean low water and 100 feet wide was dredged through the inlet and shoal outside.

The existing project for improvement, adopted September 19, 1890, and modified August 18, 1894, provides for dredging a channel through the harbor entrance 12 feet deep and 200 feet wide, to be protected by extending and enlarging the previously built jetties. Estimated cost, $145,000.

Up to June 30, 1909, $97,156.35 had been expended on the present project; of this amount $5,929.64 was for maintenance.

About 67 per cent of the work proposed under the present project has been completed, and has resulted in making a channel 12 feet deep at mean low water, and 200 feet wide, and in completing the east jetty to its full projected section for a distance of 1,550 feet, except at the shore end, where it is covered by sand. The west jetty is 940 feet long, with scant cross section. No work has been done on this jetty under the present project. The dredged channel has maintained its projected depth during the past year.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to dredging for maintenance if found necessary.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1909, is probably 12 feet at mean low water. Mean range of tides at entrance, 7 feet; at Port Jefferson wharves, 6.2 feet. The total length of navigable channel from Long Island Sound to Port Jefferson wharves is about 2½ miles. The harbor is about 2 miles long and three-fourths of a mile wide.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, farm produce, fish, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	24,940	$360,200	1905	19,650(?)	$565,700(?)
1899	42,130	2,145,940	1906	118,705	2,544,900
1903	46,670	776,000	1907	95,455	1,066,665
1904	8,832(?)	90,424(?)	1908	127,230	1,536,000

Freight rates have probably been reduced as a result of this improvement.

For detailed report see Report of the Chief of Engineers for 1900, page 1393. A sketch of Port Jefferson Harbor is printed in Report of the Chief of Engineers for 1900, page 866.

July 1, 1908, balance unexpended	$15, 208. 78
June 30, 1909, amount expended during fiscal year, for works of improvement	12, 808. 78
July 1, 1909, balance unexpended	2, 400. 00
Amount (estimated) required for completion of existing project	51, 373. 29
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	([a])

(*b*) *Mattituck Harbor.*—This harbor is a tidal inlet extending in a southerly direction from Long Island Sound to the village of Mattituck, Long Island. One mile above the mouth a tide milldam with gates and fixed bridge has been built across the stream. Before improvement the entrance was obstructed by a shifting sand bar, rising to within from 1 to 2 feet below the mean low-water plane; thence up to the milldam the depth was from 2 to 7 feet at low tide; and above the latter 6 feet at high tide.

The project adopted by the act of June 3, 1896, provides for a channel 7 feet deep at mean low water from the entrance to the dam and 7 feet deep at mean high water above the dam to the village, the width to be 80 feet, except near the mouth, where it is increased to 100 feet; the entrance channel to be protected by two parallel jetties, 400 feet apart, extending out to the 9-foot curve. Estimated cost, $83,000.

Up to June 30, 1909, $56,258.82 had been expended on the project; of this amount, $3,700 was for maintenance. There was received from sales of maps $4.35.

About 68 per cent of the work proposed under the project has been completed, resulting in building the west jetty to full projected section for a length of 680 feet, extending out to the 10-foot contour; the east jetty to full projected section for a length of 775 feet, extending out to the 7-foot contour; and in dredging a channel at the entrance 7 feet deep at mean low water, 100 feet wide, and about 1,400 feet long, thence a distance of about 400 feet, the same depth and 80 feet wide; and thence a distance of about 2,000 feet, the same depth and 60 feet wide.

The harbor is now used as an anchorage by a number of oyster vessels which have recently commenced operations in this vicinity.

A recent survey has shown the necessity of extending both jetties into deeper water and of connecting the inner end of the west jetty with the shore above high water. It is also shown that the volume of dredging required to complete the channel to the milldam is approximately 63,000 cubic yards in excess of the amount estimated in 1891 when the project was submitted. To complete the project as far as the dam, located about 1¼ miles below Mattituck, an expenditure of $53,200 will be required in addition to the funds now available.

---

[a] See consolidated money statement on page 139.

It is recommended that the improvement be extended beyond the milldam only after the local authorities have removed the dam and replaced the fixed bridge by a bridge with draw spans.

The available funds and additional appropriation recommended are to be expended in continuing the improvement and in maintenance.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the unimproved channel below the milldam at mean low water is about 1½ feet; above the milldam the least depth is about 6 feet at mean high water. The head of navigation is at the village of Mattituck. The total length of navigable channel from Long Island Sound to the milldam is about 1 mile; thence to Mattituck about 1¼ miles. The mean range of tides outside the entrance is 4.8 feet, and below the milldam, which before dredging in the entrance was 2.2 feet, is now 4.4 feet.

The commerce consists principally of coal, building materials, fruits, farm produce, and general merchandise, and was reported in 1904 as amounting to 56,602 tons, valued at $2,041,766. The commerce by water during the calendar year 1908, mostly in fish and farm produce, amounted to 1,100 tons, valued at $22,000. As a result of the improvement several thousand acres of oyster beds have been recently established in the vicinity, the boats used in the industry finding a safe harbor in the river.

No change in freight rates has yet resulted, the work not being sufficiently advanced.

For detailed description of this work see Annual Reports of the Chief of Engineers for 1891, page 843, and 1897, page 1095.

July 1, 1908, balance unexpended		$39,314.38
Received from sales		1.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		6,000.00
		45,315.88
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$17,013.35	
For maintenance of improvement	3,557.00	
		20,570.35
July 1, 1909, balance unexpended		24,745.53
July 1, 1909, outstanding liabilities		4,726.07
July 1, 1909, balance available		20,019.46
July 1, 1909, amount covered by uncompleted contracts		12,173.90
Amount (estimated) required for completion of existing project		[a] 53,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		(b)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(c) *Huntington Harbor.*—This harbor is a narrow tidal estuary extending inland from Huntington Bay, Long Island, in a southerly direction for a distance of about 2 miles.

---

[a] Revised estimate of cost of completing that part of the project below the mill dam.

[b] See consolidated money statement on page 139.

Before improvement it had a natural available depth of nearly 8 feet, mean low water, for a stretch of 1¼ miles from the entrance southward, thence gradually decreasing to zero toward the head of the harbor.

In 1872 the first project was adopted, under which in 1873 a shoal at the harbor entrance was removed and a channel 2,200 feet long, 130 to 150 feet wide, and 8 feet deep at mean low water was dredged up to the town landings at a total cost of $22,500. In 1884 this channel had completely filled up.

The present project, adopted September 19, 1890, provides for dredging and maintaining a channel 8 feet deep at mean low water and 100 feet wide up to the upper wharves, to be protected by piling, if necessary. Estimated cost, $32,000.

Up to June 30, 1908, $38,000 had been expended on this project; of this amount $8,510.94 was for maintenance.

The present project is completed, except as to the dredging or pile construction necessary to maintain the channel. For purposes of maintenance the channel has been dredged 200 feet wide in lieu of pile protection. The dredged channel has deteriorated to a considerable extent.

The appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the improved channel is estimated at about 8 feet at mean low water in about mid-channel; less depth than is reported to exist over a bar at the harbor entrance.

Mean range of tide, 7.2 feet. The head of navigation is at a causeway about one-third of a mile above Town dock. The total length of navigable channel from Huntington Bay to the causeway is about 2 miles.

The tonnage and value of the commerce of this harbor, mainly in coal, farm produce, building material, and miscellaneous merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	23,584	$473,109	1904	94,950	$2,818,250
1899	46,500	605,000	1906	105,212	2,774,850
1900	45,600	768,000	1907	96,196	1,901,061
1901	52,000	875,800	1908	38,316	413,218
1903	66,000	1,086,000			

This improvement has resulted in a material reduction in freight rates.

For detailed description see Report of the Chief of Engineers for 1897, page 1100. A sketch of the upper part of the harbor is printed in the Annual Report for 1904, page 1023.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement .... ([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*d*) *Glencove Harbor.*—This harbor is a small tidal inlet on the east side of Hempstead Harbor, Long Island. Its channel is about

---

[a] See consolidated money statement on page 139.

2 feet deep at mean low water and a bar at the entrance has a foot less of depth. Before improvement vessels waiting for tides to enter the harbor were exposed to storms from the north and northwest.

The existing project, adopted August 11, 1888, and revised June 22, 1895, provides for the construction of a breakwater in Hempstead Harbor extending from the northwest corner of Glencove dock west-southwesterly toward Motts Point, so as to shelter the anchorage outside of Glencove Harbor. The breakwater is to have a length of 2,000 feet and to be built to a height of 3 feet above high water, with a top width of 5 feet. Estimated cost, $135,000.

Up to June 30, 1909, $72,000 had been expended on the project, all for improvement.

About 53 per cent of the work contemplated under the project has been completed and has resulted in building 1,564 feet of the breakwater to full projected section.

The present length of breakwater appears to afford sufficient protection to vessels seeking shelter from storms in this vicinity, and its further extension therefore seems to be unnecessary.

The maximum depth in the anchorage behind the breakwater is estimated at 21 feet at mean low water. Shoaling is reported to have occurred in the vicinity of the wharves and landings at the inner end of the breakwater. Mean range of tides, 7.7 feet. The head of navigation is at the southern extremity of Hempstead Harbor, about 3½ miles from the breakwater.

The commerce of the harbor is chiefly coal, and amounted to 8,549 tons, valued at $40,515, in 1904, and to 7,062 tons, valued at $18,000, in 1906.

This improvement has no immediate effect on freight rates.

For details of improvement see Report of the Chief of Engineers for 1897, page 1103. A map is printed in Report of the Chief of Engineers for 1889, page 728.

Amount (estimated) required for completion of existing project............. $63,000

(*e*) *Flushing Bay.*—Flushing Bay is on the north shore of Long Island, about 14 miles by water from the Battery, New York City. The bay is about 1 mile wide and 2 miles long, the depth in the original channel being not much greater than elsewhere in the bay. Before improvement the controlling depth up to Flushing was 3.9 feet at mean low water.

The existing project, adopted March 3, 1879, and modified September 19, 1888, and June 9, 1891, provides for building a dike 4,663 feet long on the west side of the channel to protect it from filling and for making and maintaining a channel 6 feet deep at mean low water up to the lower bridge at Flushing. Estimated cost, $173,500.

Up to June 30, 1909, $160,761.19 had been expended on the project. During progress of work it has been repeatedly necessary to redredge some parts of the channel, so that it is not possible to state exactly what part of above sum was used for maintenance. The expenditure to June 30, 1909, for maintenance is estimated at $13,132.24.

The project has been completed except as to removing a small shoal below Broadway Bridge, and to making such slight changes in the outer end of the dike as to make it less of an obstruction to navigation. There is now a channel having a least depth of 6 feet at mean low water, and 200 feet wide up to Broadway Bridge, except as to the above-mentioned shoals. Thence to Main Street Bridge of the Long Island Railroad Company the channel is 100 feet wide and not less than 6 feet deep at mean low water. The whole of the dike is in bad condition, and all of the outer end, 1,606 feet long, with the exception of a few scattering piles and stones, has been carried away by storms and ice. Dike construction was discontinued in 1891.

The available funds are to be applied to making such slight changes in the dike as may be necessary to make it less of an obstruction to navigation, and to completing the improvement, and the additional appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried June 30, 1909, from East River to just beyond the Main Street Railroad Bridge at mean low water is estimated at 6 feet. Mean range of tides, 7.1 feet. The head of navigation is 1 mile above Strong's causeway. The total length of the navigable channel is about 5½ miles.

The tonnage and value of the commerce of Flushing Bay, mainly in coal, building materials, dyewoods, and miscellaneous merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	163,395	$1,449,438	1904	142,996	$2,599,488
1899	158,755	1,534,937	1905	142,274	2,656,650
1901	200,473	4,196,406	1906	273,312	3,937,444
1902	186,000	1,613,100	1907	232,911	2,537,825
1903	110,100	960,750	1908	126,455	1,774,900

This work has facilitated transportation, but no appreciable effect on freight rates has been ascertained.

For detailed description of improvement, see Report of the Chief of Engineers for 1897, page 1106. A map is printed in the Report of the Chief of Engineers for 1903, page 868.

July 1, 1908, balance unexpended		$2,809.68
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,138.63	
For maintenance of improvement	432.24	
		1,570.87
July 1, 1909, balance unexpended		1,238.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		[a]
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*f*) *Canarsie Bay.*—This bay forms the northwest part of Jamaica Bay at Canarsie Landing. The original depth from the landing to Big channel was 4.2 feet and to Island channel 1.3 feet at mean low water.

The project for this improvement, adopted June 14, 1880, and subsequently enlarged in 1889 and 1896, provides for the construction of two dikes and dredging between them where necessary to secure a channel 100 to 150 feet wide and 6 feet deep, connecting the steamboat dock at Canarsie with Big channel, Jamaica Bay; also for a channel 4 feet deep and about 50 feet wide, running in a southwesterly direction from Canarsie Landing to Island channel, and for a channel 5 feet deep and 50 feet wide, running in a northeasterly direction to Gophel channel. Estimated cost, $88,000.

---

[a] See consolidated money statement on page 139.

Up to June 30, 1909, $72,807.46 had been expended on the project; of this amount $2,935.10 was for maintenance.

The work of improvement under the project has been completed. The dredged channels have deteriorated somewhat, and the dikes are in poor condition.

The available funds are to be applied to maintenance.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the channel at mean low water is estimated at 6 feet in the main channel; in about midchannel, 2½ feet in the West Branch; and 3 feet in the East Branch. Mean range of tides, 4.7 feet. The total length of navigable channel is about 1 mile. The head of navigation is at Canarsie Landing.

The tonnage and value of the commerce of this improvement, mainly in building materials, fertilizers, fish, and coal, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1896	50,000	$427,375	1905	95,460	$1,714,022
1901	450,000	2,000,000	1907	127,515	413,784
1904	124,594	1,861,008	1908	240,075	1,125,290

The commerce in Jamaica Bay has been greatly benefited by this improvement. Transportation has been developed, but no reduction of freight rates has been ascertained.

Pending action by Congress upon a plan for improvement of Jamaica Bay, submitted in compliance with river and harbor act of March 2, 1907, it is recommended that no appropriation be made for improvement or maintenance of the channel of Canarsie Bay, which bay opens into Jamaica Bay.

Details as to this improvement may be found in Report of the Chief of Engineers for 1897, page 1114. A sketch of Canarsie Bay is printed in Report of the Chief of Engineers for 1904, page 1026.

July 1, 1908, balance unexpended	$3,033.84
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	91.30
July 1, 1909, balance unexpended	2,942.54

CONSOLIDATED.

July 1, 1908, balance unexpended		$60,366.68
Received from sales		1.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		6,000.00
		66,368.18
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$30,960.76	
For maintenance of improvement	4,080.54	
		35,041.30
July 1, 1909, balance unexpended		31,326.88
July 1, 1909, outstanding liabilities		4,726.07
July 1, 1909, balance available		26,600.81
July 1, 1909, amount covered by uncompleted contracts		12,173.90
Amount (estimated) required for completion of existing project		167,573.29
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		46,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix E 6.)

7. *East River and Hell Gate, New York.*—East River, a tidal strait separating New York City from Long Island, extends from the Battery to Throgs Neck, a distance of about 16 miles. In its original condition it was obstructed by rocks and reefs, especially in the part known as Hell Gate.

The improvement of this waterway was commenced in 1852, under a project prepared in 1848, which contemplated the removal of rocks at Hell Gate and Diamond Reef. The amount expended under this project was $33,861.59.

The existing project for improvement, adopted in 1868, and modified in 1870, 1874, 1884, 1889, 1891, and 1899, provides for the removal of rocky obstructions from the channel between the Battery and Baretto Point to depths varying from 18 to 26 feet, and for the construction of sea walls and dikes where necessary to guide the tidal currents. The cost of the work was estimated at $5,639,120. This is the estimated cost for removal of reefs and rocks only at Hell Gate, Diamond and Coenties reefs, and Man-o'-War rock. But from time to time other obstructions have been removed with the approval of higher authority, though no addition has been made to the estimated cost of the project. The locations of these obstructions are reported below. To these works should be added the construction of a crib between Great and Little Mill rocks, and the dredging of channels connecting the main channel with the posts of Davids Island and Fort Totten. The cost of this extra work, extending over a period of twenty-seven years, is $575,416. The amount required to complete the project is therefore increased in this report by that amount, less $335,466, not required under the estimate for removing Man-o'-War rock, or a net increase of $239,950.

Up to June 30, 1909, $4,883,519.97 had been expended; of this amount $4,308,005.95 had been expended on the present project for improvement; $98.02 was for maintenance, and the balance, $575,416, on the works above enumerated not included in the original project. There was received from sales of condemned property and maps $1,336.25.

About 73 per cent of the work proposed under the present project has been completed and has resulted in the removal to the contemplated depths of Diamond reef, off Governors Island; Coenties reef, off Coenties slip; Third street reef; Pilgrim rock, off Twentieth street; Charlotte rock, off Hunters Point; Man-o'-War rock, off Thirty-ninth street; Hallets Point, Ways reef, Shell Drake, and Scaly rock, in Hell Gate; North Brother Island reef; reef off Barretto Point; and in the partial removal of the following:

Localities.	Least original depth.	Least present depth.	Least proposed depth.
	Feet.	*Feet.*	*Feet.*
Battery reef	12.8	12.8 to 26+	26
Reef off South Ferry slips	17.0	19 to 26+	26
Shell reef off Tenth to Nineteenth streets	7.5	13	18
Ferry reef off Thirty-fourth street	7	24	26
Middle reef (including Flood rock, Gridiron, Hen and Chickens, and Negro Heads)	+ 6	18.3	26
Frying Pan reef	11	18	26
Pot rock	20	22.8	26
Heel Tap	12.1	20.5	26

The available funds and additional appropriation recommended are to be applied to making a resurvey of such part of the present project as may be necessary, including any ledge or ledges of rock near to the westerly shore, in completing the removal of Pot rock, and Frying Pan reef, nearly all of Middle reef, and in removing parts of obstructions above enumerated as not completed.

The maximum draft that could be carried at mean low water June 30, 1907, through the main channel from the Battery to Long Island Sound is estimated at 26 feet. The length of this waterway is about 16 miles. The range of tide south of Hell Gate is from 4½ to 5 feet, and east of it from 5 to 7 feet.

The traffic in East River is very great, and is intimately connected with that of New York Harbor proper. It is impracticable to show what proportion belongs to East River, especially as the heaviest coastwise traffic is carried on in vessels which do not enter or clear at the custom-house.

The improvement of the river has been of great benefit to both local and through traffic, which is very large in amount; its effect on freight rates can not be determined.

Attention is invited to the report of the district engineer relative to the desirability of removing obstructions in the channel between South Brother Island and Lawrence Point and of increasing the present depth of about 18 feet over Middle Ground to 26 feet; and to providing a channel of 26 feet between North and South Brother islands. These suggested improvements are deemed worthy of consideration.

Report upon an examination and survey of the river between North Brother and South Brother islands, and map of the locality, are printed in House Document No. 1084, Sixtieth Congress, second session. Preliminary report of resurvey of East River and Hell Gate is printed in House Document No. 1187, Sixtieth Congress, second session.

Detailed description of this improvement is printed in the Reports of the Chief of Engineers for 1868, page 741; for 1874, Part 2, page 164, and for 1897, page 1026.

July 1, 1908, balance unexpended	$384,462.44
Received from sales	.50
	$384,462.94
June 30, 1909, amount expended during fiscal year, for works of improvement	83,305.21
July 1, 1909, balance unexpended	301,157.73
July 1, 1909, outstanding liabilities	9,237.66
July 1, 1909, balance available	291,920.07
July 1, 1909, amount covered by uncompleted contracts	161,662.04
Amount (estimated) required for completion of existing project	1,031,390.59
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

(See Appendix E 7.)

8. *Harlem River, New York.*—The Harlem River and Spuyten Duyvil Creek, both included in the improvement, are two waterways of a joint length of about 8 miles which join at Kingsbridge, N. Y., and separate Manhattan Island from the mainland. The narrow channel at their junction was obstructed by a ledge of rocks awash at low tide.

Before improvement the Harlem River had an available depth of 10 feet at mean low water from the East River to Morris dock, except at Highbridge, where it was only 6 feet deep. From Morris dock to Fordham Landing there was a crooked channel 7 feet deep, and above the latter place the river could be used only by the smallest class of vessels. Spuyten Duyvil Creek, from Kingsbridge to the Hudson, had a depth of 4 feet.

The original project for improvement, adopted in 1874, provided for the removal of old bridge piers, Candle Factory reef, and bowlders at various places near the East River to a depth of 12 feet, the cost of the work being estimated at $167,875.56. In furtherance of this project $21,000 was expended.

The existing project, adopted June 18, 1878, and modified October 7, 1886, provides for a continuous channel 400 feet wide and 15 feet deep from the East River to the Hudson River, except about 1,300 feet north of Highbridge, where the width was made 375 feet, and at the rock cut through Dyckmans Meadow, where the width was reduced to 350 feet and the depth increased to 18 feet. Estimated cost, $2,700,000.

On June 30, 1909, $1,530,824.50 had been expended on the present project, all for improvement. There was received on account of reimbursements for damages to government property $108.97, and from the sale of maps $2.10.

About 57 per cent of the work proposed under the present project has been completed, resulting in making a channel 15 feet deep at mean low water and width of about 400 feet from Willis Avenue Bridge to the Madison avenue permanent bridge except immediately north of the easterly pier of the Second Avenue Bridge, where ledge rock projects above the improvement plane; thence to One hundred and forty-fifth Street Bridge the same depth and 250 to 300 feet in width; thence to Macombs Dam Bridge the same depth and 150 feet in width. The available depth through the westerly draw channel at Macombs Dam Bridge is about 12 feet; the channel through the easterly draw opening is not navigable, being obstructed by a rocky ledge which projects above the low-water plane to within a short distance of the rest pier. Below Willis Avenue Bridge between One hundred and twenty-second and One hundred and twenty-sixth streets, the channel of 15 feet depth is about 100 feet wide; both above and below this section of the river the width rapidly increases to 400 feet and over. In 1907 a channel 15 feet deep and 150 feet wide was dredged from Macombs Dam Bridge to the Hudson River; it is probable that since this work was completed the channel has been narrowed by the filling in of material from the sides. The rock cut through Dyckmans Meadow has been completed.

The available funds and additional appropriation recommended are to be applied to continuing the improvement at and east of Macombs Dam Bridge.

The maximum draft that could be carried June 30, 1909, through the channel from East River to Hudson River at mean low water is estimated at 15 feet, except through the channel at Macombs Dam Bridge, where the depth is but about 12 feet.

The mean range of tides in Harlem River as determined in 1907 is as follows: At Mill Rock, 5 feet; Willis Avenue Bridge, 5.1 feet; Macombs Dam Bridge, 4.7 feet; Broadway Bridge, 3.8 feet; Spuyten Duyvil Bridge, 3.7 feet. The total length of water way is about 8 miles.

The tonnage and value of the commerce of this river, which is general in character, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	7,533,594	$203,707,376	1906	11,385,649	(?)$104,359,757
1903	6,910,386	282,186,100	1907	12,385,507	313,380,743
1904	9,130,763	231,384,004	1908	[a]43,768,658	410,100,000
1905	9,998,021	270,210,309			

[a] Increase due to failure in past on the part of large transportation interests to respond to requests in past years for statistics.

The principal benefit derived from the improvement has been in the way of increased facilities for handling shipments, which make a material saving in the cost of transportation.

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1887, page 665, and 1897, page 1019.

July 1, 1908, balance unexpended	[a]$98,500.14
Collection damage to drill scow *Hudson*	67.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	22,000.00
	120,567.94
June 30, 1909, amount expended during fiscal year, for works of improvement	84,281.37
July 1, 1909, balance unexpended	36,286.57
July 1, 1909, outstanding liabilities	8,252.80
July 1, 1909, balance available	28,033.77
July 1, 1909, amount covered by uncompleted contracts	11,919.40
Amount (estimated) required for completion of existing project	1,133,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix E 8.)

9. *Newtown Creek, New York.*—This creek, an inlet of the East River, extending inland between Kings and Queens counties, N. Y., for a distance of about 4 miles, had a natural depth varying from 12½ feet at the mouth to 4 feet at the head of navigation.

The original project, adopted in 1880 and modified in 1884, provided for a channel 240 feet wide and 21 feet deep from the mouth to the Vernon Avenue Bridge; thence to the head of navigation on both branches or channels decreasing from 175 to 100 feet in width and from 18 to 10 feet in depth. The cost of the work was estimated at $255,500. In carrying out this project $197,500 was expended.

The existing project, adopted June 3, 1896, is to secure a uniform channel, 125 feet wide and 18 feet deep, from the East River to the head of navigation in the creek and in English Kills at the Metropolitan avenue bridges, at an estimated cost of $450,000. This estimate was subsequently reduced to $228,000.

Up to June 30, 1909, $221,364.88 had been expended on the project. Of this amount $21,420.31 was for maintenance.

About 94 per cent of the work proposed under the present project has been completed, resulting in a channel of the projected width and depth, with the exception of some widening at the entrance. The dredged channel has deteriorated to a considerable extent.

The available funds and additional appropriation recommended are to be applied to completing the improvement and to maintenance.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1909, at mean low water is probably not more than 16 feet. The mean range of tides is about 4½ feet. The total length of navigable channels is about 4 miles. The head of navigation in the creek and kills is at the Metropolitan avenue bridges.

---

[a] Error of 50 cents in report for year ending June 30, 1908; sale of maps credited to Hudson River should have been credited to Harlem River.

The tonnage and value of the commerce of this creek, mainly in coal, building materials, oil, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1903	2,675,025	$90,535,640	1906	2,803,380	$214,714,751
1904	3,771,726	108,313,377	1907	3,108,374	175,229,346
1905	3,428,404	130,812,974	1908	4,181,528	229,994,008

The increased depth resulting from this improvement has greatly benefited commerce.

Freight rates have been reported as greatly reduced by this improvement. It is difficult if not impracticable to ascertain details; but the large and valuable commerce of this water is the best index to the effect of the improvement.

Detailed descriptions of this improvement are printed in the Reports of the Chief of Engineers for 1896, page 760, and 1900, page 1411. A sketch of the locality is printed in Report of the Chief of Engineers for 1904, page 1034.

July 1, 1908, balance unexpended		$19,828.54
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,335.11	
For maintenance of improvement	1,458.31	
		2,793.42
July 1, 1909, balance unexpended		17,035.12
July 1, 1909, outstanding liabilities		63.41
July 1, 1909, balance available		16,971.71
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix E 9.)

10. Wallabout channel, New York.—This channel consists of a waterway extending in a half circle around the inside of the island known as Cob dock, which lies in Wallabout Bay, a slight indentation of the East River, off the United States navy-yard at Brooklyn, N. Y., and is part of the United States property. Wallabout channel connects with the East River east and west of Cob dock.

The channel is separated into two parts, called the "east" and "west" channels, by a stone causeway which connects the mainland with Cob dock. The east channel, which is about 2,000 feet long and from 250 to 350 feet wide, and had available depths of from 16 to 20 feet along the line of deepest water, diminishing to 5 feet along the sides, is the part embraced in the approved project for improvement.

The existing project, adopted in 1899, is to secure a depth of 20 feet at mean low water and widths ranging from 230 to 350 feet from the entrance of the channel to the timber causeway; practically to the stone causeway constructed northward of the timber causeway.

The channel was secured in accordance with the project in 1900, at a cost of $18,173.69.

Up to June 30, 1909, $19,923.62 had been expended on the project. Of this amount, $1,749.93 was expended in resurveying the locality for the purpose of determining the amount of work necessary to restore the channel to its projected dimensions.

The available funds will be applied to the restoration of the channel. The maximum draft, at mean low water, that could be carried over the shoalest part of the channel June 30, 1909, is probably not more than 18 feet. Mean range of tides 4 feet. Total length of navigable channel is about one-half mile. The head of navigation is at the causeway.

The commerce of Wallabout channel, mainly in coal, sugar, sirups, ice, lumber, and produce, amounted in 1897 to 340,300 tons, valued at $16,008,000; and in 1908 to 937,384 tons, valued at $4,444,600.

A detailed description of this improvement is printed in the Report of the Chief of Engineers for 1899, page 1242. A sketch of the locality is printed in House Document No. 50, Fifty-fifth Congress, third session.

July 1, 1908, balance unexpended	$21,826.31
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,749.93
July 1, 1909, balance unexpended	20,076.38

(See Appendix E 10.)

11. Browns Creek, New York.—This is a narrow stream which empties into Great South Bay, Long Island, near Browns Point. It had originally a depth of from 1 to 3 feet at low water, a bar at the mouth having less than 1 foot.

The project for improvement, adopted September 19, 1890, provides for a channel 100 feet wide and 4 feet deep, to extend from deep water in the bay up to Sayville highway bridge, and to be protected at the entrance by jetties on both sides. Estimated cost, $46,000.

Up to June 30, 1909, $31,301.86 had been expended on the project, of which amount $6,301.86 was for maintenance.

There was received from the sale of maps $1.38.

About 54 per cent of the work proposed under the project has been completed, resulting in the building of two jetties at the entrance and in the dredging of a channel 100 feet wide and 4 feet deep at mean low water for a distance of 3,200 feet from the entrance. Because of shoaling this dredged channel was redredged in 1905 to 4 feet depth at mean low water for a distance of about 1,200 feet from the end of the jetties.

The west jetty is 492 feet long and the east jetty 438 feet long, both with top width of 3 feet at 1 foot above high water, and both partly covered at the shore end by accretion. They are in bad condition.

Disbursements during the year were in payment of office expenses and of the cost of an examination of the locality.

The available funds and additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried over the shoalest part of the dredged channel at mean low water June 30, 1909, is about 2½ feet; mean range of tides, 1 foot. The head of navigation is at the Sayville highway bridge, about 1¼ miles from the mouth.

Because of rapid deterioration, due mainly to the inflow of mud from the marshes bounding the channel, $6,204.83 has already been expended in redredging, and the jetties, built only to about one-third of their projected lengths, are in a very bad condition.

The total cost of completing the project will be much greater than the original estimate, and if the channel, which is now only 3,200 feet long and requires redredging, is extended upstream, the expenditure for maintenance will increase proportionately.

Considering the limited number of vessels using this creek for transportation purposes, the cost of improving and maintaining the entire length of the creek to Sayville, and completing the breakwaters as projected, would be out of proportion to the benefits to be derived therefrom. It is therefore recommended that future appropriations be made, not for extending the improvement, but only for maintaining the present dredged channel.

The tonnage and value of the commerce of this creek, mainly in coal, building materials, and fish, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	10,700	$213,800	1904	24,000	$807,075
1899	11,642	251,350	1905	51,675	1,811.195
1901	17,025	454,500	1906	29,675	983,880
1902	17,630	299,300	1907	34,975	1,043,865
1903	20,380	609,450	1908	25,240	924,780

This improvement has resulted in providing a harbor for fishing boats, but has had no appreciable effect on freight rates.

Details in reference to this work appear in Reports of the Chief of Engineers for 1897, page 1111, and for 1900, page 1417. A sketch of the creek is printed in Report of the Chief of Engineers for 1894, page 710.

July 1, 1908, balance unexpended	$4,795.17
Received from sales	1.38
	4,796.55
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	97.03
July 1, 1909, balance unexpended	4,699.52
Amount (estimated) required for completion of existing project	16,301.86
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E 11.)

12. *Great South Bay, New York.*—The first project, adopted September 19, 1890, provided for the improvement of the Patchogue River, a small inlet extending from Great South Bay, Long Island, to the village of Patchogue. This stream had, before improvement, a depth of 2 feet. The project provided for a channel about 5,000 feet long, 60 feet wide, and 6 feet deep, to be protected at its mouth

against westerly storms by a jetty 1,700 feet long. Estimated cost, $40,000. On June 30, 1902, there had been expended on this work $40,000, and the project was completed.

The present project, adopted June 13, 1902, provides for dredging a channel from Fire Island Inlet, which connects Great South Bay with the ocean, to Patchogue, on Patchogue River. From the inlet to the central basin in Great South Bay the channel is to be 10 feet deep at mean low water and 200 feet wide. From the central basin to Patchogue the channel is to be 8 feet deep and 100 feet wide at mean low water. Estimated cost $66,000, and $2,000 annually for maintenance.

Up to June 30, 1909, $66,813.93 had been expended on the project, of which amount $6,993.11 was for maintenance. There was received from the sale of maps $2.92. About 90 per cent of the work contemplated under the present project has been completed, resulting in a channel 200 feet wide and 10 feet deep at mean low water in the bay, except at bars "A" and "B;" and in the completion of a channel 100 feet wide and 8 feet deep at mean low water in the river. Considerable shoaling has occurred in the latter.

Expenditures during the past fiscal year were for payment of contractor's retained percentages, examination of channel conditions, printing, advertising, etc.

A recent examination of Patchogue River has shown that to maintain the channel at a minimum of cost the present west jetty should be extended to at least the 7-foot contour in the bay; an easterly jetty should be built out from the shore to the same contour; and the channel should be redredged throughout its length to the projected depth of 8 feet below mean low water. The estimated cost of this work is $75,000, in addition to the funds now available. Further details concerning this item are given in the report of the district officer.

The available funds and the additional appropriation recommended are to be applied to maintenance, by dredging, leaving it for Congress to decide whether the jetties shall be built to aid in maintaining the project depth as proposed by the district officer.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the channel from Fire Island Inlet to central basin was 8.5 feet and in Patchogue River 5 feet.

Mean range of tides, 1 foot. The head of navigation in Patchogue River is at a fixed bridge at Division street, Patchogue. The total length of navigable channel from Fire Island Inlet to Patchogue is about 17½ miles and to Belleport 22 miles.

The tonnage and value of the commerce of this locality, mainly in coal, lumber, and fish, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	255,200	$3,702,000	1904	257,879	$4,037,130
1899	266,800	3,808,500	1905	224,526	3,871,850
1900	274,100	3,919,000	1906	232,500	4,014,000
1901	281,200	4,025,000	1907	224,108	3,903,723
1902	257,500	4,000,000	1908	195,000	3,320,000
1903	258,500	3,995,000			

The effect of the work has been to facilitate commerce. No reduction in freight rates has been ascertained.

For details as to improvement see Patchogue River, Reports of the Chief of Engineers for 1897, page 1108; for 1901, page 1249, and for 1903, page 134. A sketch is printed in Report of the Chief of Engineers for 1903, page 876.

July 1, 1908, balance unexpended	$4,018.24
Received from sales	1.47
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	7,019.71
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	830.72
July 1, 1909, balance unexpended	6,188.99
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E 12.)

13. *Hudson River, New York.*—The portion of this river which is now under improvement is the stretch beginning at the State dam at Troy and extending downstream to Coxsackie, a distance of 28 miles. In its natural condition the channel was narrow and crooked, with a navigable depth of 4 feet between the State dam and Albany, of 7½ feet between Albany and New Baltimore, of 11 feet between New Baltimore and Coxsackie, and of 12 feet or more below Coxsackie.

The original project for improvement, adopted in 1834, modified in 1852 and again in 1866, had for its object the securing of a navigable channel of sufficient width and 9 feet deep between Troy and Albany, and 11 feet deep between Albany and New Baltimore. In carrying out this work $1,667,938 was expended.

The existing project, adopted July 13, 1892, and modified March 3, 1899, provides for a 12-foot channel 150 feet wide from the State dam to the foot of Jacob street, Troy; thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie. This work was estimated to cost $4,343,863. The act of March 3, 1905, authorized the expenditure, in the discretion of the Secretary of War, of $85,000 of the amount appropriated by that act for improving Hudson River, for the removal of Stonehouse bar, opposite New Baltimore. Forty thousand two hundred and eighty-eight dollars and forty-two cents has been expended on this work. The same act authorized the expenditure of not exceeding $10,000 in providing a channel for access to the harbor of Tarrytown, all of which amount has been expended under this authority. The act of March 2, 1907, authorized the expenditure of $5,000 in removing the bar and deepening the channel at the mouth of Schodack Creek. Under this authority $4,432.37 was expended.

On June 30, 1909, $3,740,335.60 had been expended; of this amount $3,705,202.14 had been expended on the present project, of which $313,497.48 was for maintenance; and the balance, $54,720.79, on the works above enumerated not included in the project. There was received from sales of maps $86.52; from sale of typewriter

$35; from repayments $10.06; from reimbursements on account of removal of obstructions from the channel, $78.10.

About 85 per cent of the work proposed under the present project has been completed, resulting in a navigable channel of not less width than 190 feet, and maximum depth of 12 feet at mean low water from Coxsackie to the Delaware and Hudson Company's bridge at Troy, N. Y., except at the New York Central and Hudson River Railroad Company's freight bridge at Albany, where the channel through the draw spans is contracted to a maximum of 90 feet; and a depth of 11 feet and width of 75 feet from the Delaware and Hudson Company's bridge to within 900 feet of the sloop lock at the State dam. The depth over the miter sill of the sloop lock is 4½ feet.

The range of the tides in seasons of moderate rain varies from 2.55 feet at the State dam, 2.89 feet at Broadway, Troy, 2.84 feet at Albany, to 3.69 feet at Coxsackie, being an increase in elevation of high water of about 0.5 foot at Albany and at the foot of Broadway, Troy. The head of navigation for the tidal portion of the river is at the State dam, 153 miles from the Battery in New York City. The total length of navigable channel under improvement is 28 miles.

For results of previous tidal observations, reference is made to the Report of the Chief of Engineers for 1897, page 998, and 1900, page 1490.

The commerce within the limits of the improvement, mainly in general merchandise, farm products, building material, fuel, and ice, amounted to 3,325,360 tons, valued at $75,664,748 in 1906, to 2,881,168 tons, valued at $66,853,731 in 1907, and to 2,945,921 tons, valued at $120,421,651 in 1908.

The effect of the improvement has probably been to reduce freight rates.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

July 1, 1908, balance unexpended		[a] $196,689.19
Received, sale of maps, $35.02; sale of property, $35		70.02
Amount allotted from appropriation by river and harbor act approved March 3, 1909		39,000.00
Received by collection		4.45
		235,763.66
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$145,772.44	
For maintenance of improvement	34,310.58	
		180,083.02
July 1, 1909, balance unexpended		55,680.64
July 1, 1909, outstanding liabilities		18,688.53
July 1, 1909, balance available		36,992.11
July 1, 1909, amount covered by uncompleted contracts		3,152.90
Amount (estimated) required for completion of existing project		951,408.17
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		350,000.00

(See Appendix E 13.)

---

[a] Error of 50 cents in report for year ending June 30, 1908; sale of maps credited to Hudson River should have been credited to Harlem River.

14. Saugerties Harbor, New York.—Saugerties Harbor is the name applied to the mouth of Esopus Creek, which empties into the Hudson River from the west, about 100 miles above New York City, which creek is navigable at high water for a distance of about 6,000 feet from deep water in the Hudson River. Above the steamboat landing, which is a distance of about 4,500 feet from deep water, there is little traffic. The original depth over the bar was 3 feet at mean low water, which had been increased to 7 feet by dredging done by the State of New York in 1885–86.

The original project, which contemplated securing a permanent channel 7 feet deep at mean low water and 100 feet wide, at an estimated cost of $52,000, was adopted in 1884, modified in 1887, and completed in 1892, with an expenditure of $42,000. To June 30, 1902, $15,000 had been expended for maintenance.

The existing project, adopted June 13, 1902, provides for a channel 12 feet deep at mean low water and 200 feet wide from deep water in the Hudson River to the steamboat landing, at an estimated cost of $44,685, with an estimated annual expenditure of $2,500 for maintenance.

Up to June 30, 1909, $44,137.98 had been expended on the present project; of this amount $19,064.99 was for maintenance. There was received from the sale of maps $1.10.

About 56 per cent of the work proposed under the present project has been completed, resulting in widening and straightening the navigable channel of 12 feet depth where Barclays Point and Powderhouse reefs have been removed, and in making a fair channel from the mouth of the harbor to the steamboat landing.

The expenditure for maintenance is mainly due to restoring the channel above the reef, where, owing to the breaking of the dam a short distance above the head of navigation in the summer of 1902 and the consequent release of a large quantity of mud and silt retained by it, the channel had been reduced in width and depth so as to be practically closed to the navigation by large boats; and to the relief to navigation along the wharves on the north side of the channel, where extensive shoaling had taken place, apparently as the result of the removal of the rock off Barclays Point.

The available funds and additional appropriation recommended are to be applied to continuing the improvement, and to maintenance.

The maximum draft at mean low water that could be carried June 30, 1909, is estimated at 10½ feet, for a minimum width of 50 feet. The mean rise and fall of tides is about 4 feet. The head of navigation is at a point about 1,600 feet below the dam. The total length of navigable channel is about 1¼ miles.

The tonnage and the value of the commerce of this harbor, mainly in building materials, manufactures, fuel, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1901	67,473		1905	81,600	$1,598,000
1902	66,500		1906	83,300	1,606,200
1903	112,677		1907	95,400	1,873,000
1904	113,200	$18,832,195(?)	1908	114,000	2,070,500

The effect of the improvement, according to the best information available, is to reduce freight rates during the season of navigation.

Details in reference to this work appear in Reports of the Chief of Engineers for 1895, page 910, and 1900, page 1518. A sketch is printed in Report of the Chief of Engineers for 1904, page 1046.

July 1, 1908, balance unexpended	$16,141.87
June 30, 1909, amount expended during fiscal year, for works of improvement	12,278.75
July 1, 1909, balance unexpended	3,863.12
Amount (estimated) required for completion of existing project	15,749.99
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

(See Appendix E 14.)

15. Harbors at Rondout and Peekskill, New York.—(*a*) *Rondout Harbor.*—This harbor is situated at the mouth of Rondout Creek, on the west shore of the Hudson River, 90 miles above New York City. The creek, which is navigable to Eddyville, 3 miles from its mouth, was the most easterly section of the Delaware and Hudson Canal until that waterway was abandoned several years ago. Before improvement was begun under the adopted project a depth of 7 feet at mean low water had been obtained as a result of work done by private parties.

The original project, adopted June 10, 1872, provided for a channel 14 feet deep at mean low water and 100 feet wide, at an estimated cost of $172,500, and was completed in 1880 at a total cost of $90,000. Since then the expenditures have been for maintenance.

Up to June 30, 1909, $140,928.63 had been expended on the project. Of this amount $50,928.63 was for maintenance.

The above expenditure has resulted in making a channel 12½ feet deep at mean low water and not less than 100 feet wide.

The available funds and additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried through the channel June 30, 1909, was 13 feet at mean low water, with a least width of channel of about 75 feet. The mean rise and fall of tides is 4 feet. The head of navigation is at Eddyville. The total length of navigable channel is about 3 miles.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, building materials, fuel, and ice, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	1,469,000	$41,065,000	1907	1,255,000	$5,025,000
1905	1,325,000	46,112,500	1908	438,000	2,075,000
1906	998,524	5,640,900			

The effect of the improvement has probably been to keep the freight rates down during the season of navigation.

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1880, page 494, and for 1895, page 913. A sketch of the harbor is printed in Report of the Chief of Engineers for 1903, page 1884.

July 1, 1908, balance unexpended	$10,838.73
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	8,467.36
July 1, 1909, balance unexpended	2,371.37
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*b*) *Peekskill Harbor.*—This harbor is an indentation on the eastern shore of the Hudson River, about 46 miles above New York City, about five-eighths of a mile long and 1¼ miles wide, having before improvement a controlling depth of about 5 feet at mean low water, except near the wharves in Peekskill, where it was about 6 feet.

The original project for improvement, adopted June 3, 1896, provided for a dredged channel 10 feet deep at mean low water and 100 feet wide from deep water in the Hudson River north of the village to deep water south of it, following generally the contour of the shore, at an estimated cost of $50,000. The project was completed in 1899, at a cost of $19,400.

Up to June 30, 1909, $28,222.26 had been expended on the project; of this amount $8,822.26 was for maintenance.

Disbursements during the year were mainly in part payment of office expenses.

The channel was restored to its projected depth and width in 1907. It is probable some shoaling has occurred since then.

The available balance and the additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried through the channel June 30, 1909, at mean low water is probably less than 10 feet. Mean range of tides about 3 feet. The total length of channel is 1⅜ miles.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, building material, and fuel, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	81,265	$3,751,985	1907	107,963	$733,766
1905	74,546	1,134,748	1908[a]	226,533	4,984,046
1906	88,500	659,864			

[a] Increase mainly due to the receipt of more complete statistics for 1908 than for previous years.

A slight reduction in freight rates has been reported.

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1895, page 999, and for 1897, page 1016.

A sketch of the harbor is printed in Report of the Chief of Engineers for 1903, page 885.

---

[a] See consolidated money statement on page 153.

July 1, 1908, balance unexpended	$285.48
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	7.74
July 1, 1909, balance unexpended	277.74
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]

CONSOLIDATED.

July 1, 1908, balance unexpended	$11,124.21
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	8,475.10
July 1, 1909, balance unexpended	2,649.11
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	6,000.00

(See Appendix E 15.)

16. *Wappinger Creek, New York.*—Wappinger Creek is a small stream, which empties into the Hudson River from the east about one-half mile below the village of New Hamburg, N. Y.; it is navigable from its mouth for a distance of about 2 miles to the works of the Dutchess Company, which are located just below the falls and at the head of navigation. The entrance to the creek is through a drawbridge over which passes the New York Central and Hudson River Railroad. The depth before improvement did not exceed 6 feet, and the width of channel varied from 25 to 75 feet.

The original project for improvement, adopted September 19, 1890, provided for a channel 8 feet deep at mean low water and 80 feet wide, at an estimated cost of $13,000. The project was completed April 30, 1892, at a cost of $13,000, and resulted in making a channel of the projected width and depth.

The expenditures during the past fiscal year were for resurvey of the creek, examining new drawbridge, etc.

Up to June 30, 1909, $18,849.34 had been expended on the project; of this amount $5,849.34 was for maintenance.

To maintain the channel width and depth as projected repeated redredging is necessary. A recent survey of the creek from its mouth to the falls shows that shoaling has occurred to such extent the expenditure of the balance of funds available for this work would not result in a material benefit to navigation. It is therefore proposed to delay further work until additional funds are made available by act of Congress.

During the past year the New York Central and Hudson River Railroad Company completed the erection of a new draw of 40 feet horizontal clearance a short distance south of the old draw span, and connected the new location with the channel improved by the United States by dredging to a depth of 8 feet at mean low water, except for a few minor obstructions in the draw opening which have yet to be removed by the railroad company.

---

[a] See consolidated money statement on this page.

The available funds and additional appropriation recommended are to be applied to maintenance.

The greatest draft that can be carried, June 30, 1909, at mean low water, from deep water in the Hudson River to the head of navigation is about 7 feet. The mean rise and fall of tides at the mouth of the creek is about 3.3 feet. The total length of navigable channel is about 2 miles.

The tonnage and value of the commerce of this creek, mainly in cotton goods, clothing, building material, and fuel, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	56,927	$7,955,975	1907	44,493	$445,765
1905	49,562	4,872,903	1908	41,574	[a] 6,990,600
1906	46,194	572,399			

[a] Increase due to more accurate returns from interested parties for 1908 than for 1906 and 1907.

It is reported that commercial interests have been greatly benefited by the improvement, but no reduction in freight rates has resulted therefrom.

Details in reference to this work appear in the Report of the Chief of Engineers for 1893, page 1024. A sketch is printed in the Report of the Chief of Engineers for 1904, page 1051.

July 1, 1908, balance unexpended	$3,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,349.34
July 1, 1909, balance unexpended	1,650.66
July 1, 1909, outstanding liabilities	16.71
July 1, 1909, balance available	1,633.95
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix E 16.)

17. Tarrytown Harbor, New York.—This harbor is located on the east shore of Hudson River, about 28 miles above New York City, where the river is several miles wide. The channel is bordered on both sides by extensive flats, that on the east side measuring about three-eighths of a mile from the main wharf to the 12-foot depth in the river. The general depth in the harbor is about 4½ feet at mean low water.

Before improvement two channels of about 6 feet depth led up to main wharf.

The original project for improvement, adopted March 3, 1905, provides for a channel along the wharf front of the harbor and connecting it north and south with deep water in Hudson River, to be 12 feet deep at mean low water, and 150 feet wide along the wharf front; and 100 feet wide in the northerly and southerly connections with the Hudson River. Estimated cost, $26,000, increased in 1907 to $35,491.68, and $1,000 or $2,000 biennially for maintenance.

Up to June 30, 1909, $23,226.27 had been expended on this project, all in improvement. About 65 per cent of the work proposed under the project has been completed, resulting in a channel 100 feet wide and 12 feet deep, at mean low water, in the southern arm; 100 feet wide and 10 to 12 feet deep along the wharf front except opposite Husted's dock, where it is only 60 feet wide; 60 feet wide and 12 feet deep for 350 feet in length of the eastern end of the northern arm, and 60 feet wide but of less than 12 feet depth for a farther distance of 100 feet in the northern arm. It is probable that the dredged areas have shoaled to an appreciable extent.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

The maximum draft that could be carried in the dredged channel June 30, 1909, at mean low water, from deep water in the Hudson River south of Tarrytown to Husted's wharf in Tarrytown, is estimated at 12 feet, and from deep water in the Hudson River north of Tarrytown to the same wharf at 6 feet. Mean range of tides is about 3½ feet. The total length of projected channel is about 1⅛ miles.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, coal, and building materials, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1905	71,201	$1,830,092	1907	86,076	$3,641,915
1906	79,714	384,979(?)	1908	71,325	3,648,856

A slight reduction in freight rates has been reported as resulting from the improvement.

Detailed description of this harbor is printed in Reports of the Chief of Engineers for 1889, page 800, and 1900, page 1520.

July 1, 1908, balance unexpended	$3,985.88
June 30, 1909, amount expended during fiscal year, for works of improvement	1,212.15
July 1, 1909, balance unexpended	2,773.73
Amount (estimated) required for completion of existing project	9,491.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	12,500.00

(See Appendix E 17.)

18. Coney Island channel, New York Harbor.—This channel lies immediately south of Coney Island, at the southwestern extremity of Long Island, New York, and is one of five channels which cross the bar that separates New York lower bay from the ocean. A channel 500 to 560 feet wide and 14 feet deep at mean low water was dredged in 1900, and in 1905 this channel was redredged to a width of 400 feet. When surveyed in 1906, the least depth on the western of two bars in the channel was about 12½ feet at mean low water and about 16 feet on the eastern bar.

The present project for improvement, adopted March 2, 1907, provides for dredging a channel 20 feet deep at mean low water and 600 feet wide, with side slopes of 1 on 3 from deep water in the lower bay to deep water in the Atlantic Ocean at an estimated cost of $168,300, and $20,000 annually for maintenance.

This improvement was intended to diminish the congestion of and danger in the main channels in the lower bay by directing therefrom light-draft steamers and sailing vessels, long tows, and excursion vessels plying between New York and Coney Island or Rockaway Inlet.

Up to June 30, 1909, $52,547.39 had been expended on this project, all in improvement. There was received $36.67 on account of repayment and 33 cents from the sale of maps. About 31 per cent of the work proposed under the project has been accomplished, resulting in making a channel through the western bar 20 feet deep at mean low water and 340 feet wide. The channel dredged in 1907 has been entirely filled in, as shown by a survey made in June, 1908. The contract for this work was terminated August 27, 1908, before its completion; nothing has been done in the way of improvement since the termination of this contract. The indications are that the annual cost of maintenance may be as much as $50,000 or $60,000, one-third or more of the estimated cost of dredging the channel. Since the cost per cubic yard for dredging in this locality, if done by a government seagoing dredge, will probably be not more than about one-third of the cost by contract, it is proposed to resume this work as soon as such seagoing dredge can be assigned thereto.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1909, at mean low water is estimated at 12½ feet. The mean range of tides is about 4.6 feet. The total length of projected channel is about 1¼ miles.

The commercial interests using this channel are those of the city of New York and other cities whose commerce passes Sandy Hook. It is impracticable to state what proportion of this commerce uses Coney Island channel.

It is not expected that the dredging of this channel will affect freight rates. The channel is desired principally as a means of freeing the regular channel from use by tows entering and leaving New York Harbor.

A report upon the examination and survey of Coney Island channel and map of the locality are printed in House Document No. 442, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$160, 171. 36
June 30, 1909, amount expended during fiscal year, for works of improvement	24, 381. 75
July 1, 1909, balance unexpended	135, 789. 61

(See Appendix E 18.)

19. Removing sunken vessels or craft obstructing or endangering navigation.—*(a) Wreck of scow (name unknown).*—This scow was sunk in East Chester Bay off Wire Creek. Reported to the department June 29, 1908, and an allotment of $241.50 for its removal was made July 3, 1908. Removal was completed July 13, 1908, at a total cost of $241.50.

(*b*) *Wreck of schooner H. T. Hedges.*—This schooner was sunk about June 1, 1908, in East River, New York, opposite Whitestone, N. Y. Reported to the department June 29, 1908, and an allotment of $994.50 for its removal was made July 7, 1908. Removal was completed July 13, 1908, at a total cost of $994.50.

(*c*) *Wreck of barge Kate.*—This barge was sunk about June 23, 1908, in Bronx River, New York, about opposite One hundred and seventy-second street. Reported to the department by telegraph July 6, 1909, and an allotment of $400 for its removal was made on the same date. Removal was completed July 14, 1908, at a total cost of $373.

(*d*) *Wreck of schooner* (*name unknown*).—This schooner was sunk about June 1, 1908, in Long Island Sound, about one-half mile off Peacock Point, Long Island, N. Y. Reported to the department July 6, 1908, and allotments amounting to $275 for its removal were made July 9 and July 24, 1908. Removal was completed July 28, 1908, at a total cost of $259.

(*e*) *Wreck of barge* (*name unknown*).—This wreck consisted of a portion of a wrecked barge endangering navigation in Hudson River at Albany, N. Y. The wreckage was removed at a total cost of $48.50, and an allotment of this amount was made August 20, 1908, for defraying the cost of removal.

(*f*) *Wreck of schooner Winslow Morse.*—This wreck was first reported September 5, 1908. The owner was, upon his request, given an opportunity to raise the vessel, but being unsuccessful, was compelled to abandon her. Removal by the United States was recommended April 30, 1909, and an allotment of $375 for this purpose was made May 4, 1909. Removal was completed May 20, 1909, at a total cost of $375.

(*g*) *Wreck of barge Bessie.*—This barge was sunk in the Hudson River, New York, at Verplancks Point, and was reported to the department May 5, 1909. An allotment of $600 for its removal was made May 20, 1909. Removal was completed June 7, 1909, at a total cost of $530. The balance of the allotment, amounting to $70, is to be turned in to the credit of the Treasurer of the United States after payment of outstanding liabilities has been made

(See Appendix E 19.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated.

1. *Preliminary examination and survey of East River, New York, between North Brother and South Brother islands, with a view to obtaining depths of 20, 22, and 24 feet.*—Reports dated April 9, 1907,

and April 30, 1908, respectively, are printed in House Document No. 1084, Sixtieth Congress, second session. A plan for improvement is presented for securing channels for each of the depths named in the act, namely, 20, 22, and 24 feet, estimated to cost, respectively, $216,100, $485,990, and $750,262.

2. *Preliminary examination and survey of Echo Bay, New York.*—Reports dated April 24, 1907, and September 14, 1908, respectively, are printed in House Document No. 1118, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $22,110 is presented.

3. *Preliminary examination and survey of Port Chester Harbor, New York, with a view to obtaining a depth of 15 feet with corresponding width.*—Reports dated August 20, 1907, and October 31, 1908, are printed in House Document No. 1165, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $188,000 is presented.

4. *Resurvey of East River and Hell Gate, New York, including any ledge or ledges near to the westerly shore.*—Report dated November 13, 1908, is printed in House Document No. 1187, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $1,733,000 is presented.

5. *Preliminary examination and survey of East Chester Creek, New York, with a view to obtaining a depth of 12 feet.*—Reports dated August 24, 1907, and November 30, 1908, respectively, are printed in House Document No. 1250, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $103,000 is presented.

6. *Preliminary examination and survey of the waters of Jamaica Bay, including entrance to said bay at Rockaway Inlet and those waters having their outlet in Dead Horse Inlet, etc.*—Reports dated August 3, 1907, and January 30, 1909, are printed in House Document No. 1488, Sixtieth Congress, second session. A plan is presented for improvement at an estimated cost to the United States of $7,430,000, provided additional work contemplated by the project is undertaken and executed by local authorities and the expense thereof borne by them.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND NEW YORK, NEW YORK, DISTRICT.

This district was in the immediate charge of Brig. Gen. W. L. Marshall, Chief of Engineers, U. S. Army, to July 22, 1908, and of Col. S. W. Roessler, Corps of Engineers, since that date, having under his immediate orders Capt. Hubert L. Wigmore, Corps of Engineers, since October 11, 1908. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. *New York Harbor, New York.*—There are at present two channels of approach to New York Harbor, the Main Ship-Bayside-Gedney channel and the new Ambrose channel.

Main Ship-Bayside-Gedney channel.—Before improvement by the United States, this channel carried a depth of 23.7 feet across the outer bar at mean low water, and about the same depth across three other shoals between the bar and deep water in the harbor. A large proportion of the commerce of the port, carried in vessels of greater draft, could cross these shoals only at or near high water.

The project for the improvement of the outer portion of this channel, known as Gedney channel, was approved by the Secretary of War, December, 1884, under the provision of the river and harbor act of 1884, and in 1886 was extended to cover the whole of the main entrance. It provided for dredging a channel 30 feet deep at mean low water, and 1,000 feet wide, between the sea and deep water at the Narrows. The estimated cost was $1,490,000 for dredging 4,300,000 cubic yards. The work was substantially completed in October, 1891, by the dredging of 4,875,079 cubic yards.

The maintenance of this route has been carried on under a project approved November 15, 1892, under the provision of river and harbor act of July 13, 1892. The total expended in maintenances for the period of seventeen years since completion of project in 1892 is $687,897.28. The cost has been increasing from year to year and the present estimated amount required for maintaining the channel to full width and depth is $100,000 per year. It would not have been below this for several years if the channel had been kept its full width of 1,000 feet. The amount expended in original excavation was $1,518,024.52.

These expenditures have resulted in maintaining a channel 30 feet deep at mean low water for a width of 1,000 feet or over, except on the Main Ship channel where the width has varied from 600 to 800 feet.

The work of the fiscal year ending June 30, 1909, has consisted in the removal of 73,681 cubic yards of mud and sand from the west side of the Main Ship channel where the accretions are continuous and greatest, due to the set of the tidal current across the course of the channel. Bayside and Gedney portions of the channel are further seaward and more nearly true with the tide currents and require comparatively little dredging to maintain the full width and depth.

The length of that part of New York Harbor included in the limits of the project (from Atlantic Ocean to the Battery, New York City) is 22½ miles. The dredging has extended over about 8 miles of this route. The mean rise of tide is 4½ feet.

Ambrose channel.—Ambrose channel (formerly known as East channel) had an original available depth of 16 feet at mean low water and was used only by towboats, scows, and very light draft vessels. By the terms of the river and harbor act of 1899 a project was adopted for making an entrance to New York Harbor by this channel, to be 2,000 feet wide and 40 feet deep at mean low water. It involved an estimated excavation of about 42,500,000 cubic yards of material for a length of 7 miles of channel. The work was authorized to be done under a continuing contract at a cost not exceeding $4,000,000. Under the act of March 3, 1903, two United States dredges were built to supplement the contract work, which was far behind the required rates. In October, 1906, the contractor abandoned the work, and the river and harbor act of 1907 authorized the building of two more United States dredges, at the same time changing the authorized limit of expenditure to $5,148,510. The sum of $324,510 is yet to be appropriated under the contract authorization.

To July 1, 1909, $4,197,932.47 has been expended in building four dredges and in excavating 42,911,791 cubic yards of sand, mud, and stones. (For details of dredge construction see Appendix H 10.)

During the fiscal year ending June 30, 1909, four United States dredges were continuously engaged upon this work, excavating

10,786,638 cubic yards of sand and mud; and under contract for removing old stone dumps from the channel, 6,889 cubic yards of stones mixed with sand were taken out.

Ambrose channel has now a depth of 40 feet at mean low water, with width of about 1,000 feet. It is easily navigable at mean low tide for ships of 37 feet draft going at moderate speed, and has a maximum high water capacity of 44 feet. The project is regarded as about three-quarters completed.

This channel was first buoyed for navigation in September, 1907, and regulations were issued by the Secretary of War, under authority of law, restricting its use to daylight navigation by ships of 29 feet draft or over, or of 600 feet length or over. As the improvements progressed it became practicable to remove most of this restriction, and under authority of act of Congress of March 3, 1909, regulations were issued permitting use of the channel by day or night by all steamships or steamers not having tows, regardless of size. This was promptly made use of and now the channel is used by practically all of the transatlantic lines and many of the others.

Removal of submerged reef in North River, near Pier "A," Manhattan.—By the river and harbor act of 1905 the removal of a rock in North River near pier 1 was authorized, and funds were provided by withdrawing $20,000 from the Ambrose channel appropriation, in addition to $25,000 similarly diverted by joint resolution of Congress approved July 1, 1902. A contract was entered into for the entire removal of the rock to 40 feet depth, at cost of $40,000; the whole area of the rock had been drilled and blasted, and 363 cubic yards of rock removed up to August 11, 1908, when the contractor withdrew his plant and failed to resume work until the contract expired by limitation. A new contract was entered into to complete the work of removal, under which about 60 cubic yards of solid rock have been taken out. The total amount expended on the rock to July 1, 1909, is $5,712.45.

The foreign exports and imports for the port of New York during the year ending June 30, 1908, amounted approximately to 12,541,419 tons, valued at $1,613,031,266, being an increase over the valuation of 1886, before improvement of the entrance was begun, of $772,754,574. The entire cost of the improvement of New York Harbor up to date is less than 1 per cent of the increase in valuation of foreign commerce alone for this port since the improvement began, and less than one-half of 1 per cent of the present annual value of foreign commerce.

No statistics of local and coastwise domestic commerce are kept.

It is impossible to estimate the effect of the improvement upon freight rates. During 1908, 124 different ships, drawing 27 feet or more, made 484 trips outward and 137 trips inward. Prior to the improvement none of these ships could have crossed the bar to enter or leave the harbor except at extreme high tide or after lightering.

Further details of the harbor and improvements are printed in the Annual Report of the Chief of Engineers for 1897, page 1031.

A general description of the harbor, of the different channels, of the main entrance, and of the projects for improvement is printed in the Annual Report of the Chief of Engineers for 1901, pages 1285–1287. A map of the harbor is printed in the Annual Report for 1903, page 914.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$58,189.49
Amount allotted from appropriation by river and harbor act approved March 3, 1909	100,000.00
	158,189.49
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	59,586.77
July 1, 1909, balance unexpended	98,602.72
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	150,000.00

AMBROSE CHANNEL.

July 1, 1908, balance unexpended		[a]$793,653.23
Amount appropriated by sundry civil act approved March 4, 1909		627,000.00
Received from sale of property and maps		[b]52.70
		1,420,705.93
June 30, 1909, amount expended during fiscal year:		
For construction of dredges	$345,958.34	
For works of improvement	480,428.32	
Deposited to credit of Delaware River appropriation	11,163.07	
Transfer settlements	3.68	
		837,553.41
July 1, 1909, balance unexpended		583,152.52
July 1, 1909, outstanding liabilities		34,325.31
July 1, 1909, balance available		548,827.21
Amount (estimated) required for completion of existing project		324,510.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$324,510.00	
For maintenance of improvement	195,490.00	
		520,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

OBSTRUCTION IN NORTH RIVER.

July 1, 1908, balance unexpended	$39,708.75
June 30, 1909, amount expended during fiscal year, for works of improvement	421.20
July 1, 1909, balance unexpended	39,287.55
July 1, 1909, outstanding liabilities	2,080.20
July 1, 1909, balance available	37,207.35
July 1, 1909, amount covered bv uncompleted contracts	35,367.80

(See Appendix F 1.)

---

[a] Includes $182.04 in the hands of Major Deakyne for dredge construction.

[b] Includes $15.50 received by Major Deakyne for sale of property in connection with dredge construction.

2. *Channel in Gowanus Bay, New York Harbor, New York—Bay Ridge and Red Hook channels.*—These channels lie along the east shore of the upper bay, New York Harbor, and with Buttermilk channel form an easterly channel between the Narrows and East River, separated from the main channel by a broad shoal off Gowanus Bay and by Governors Island.

Bay Ridge and Red Hook channels had a natural low-water depth of 7 to 12 feet and were available only for a limited harbor commerce.

The original project, adopted in 1881, provided for making these channels 18 feet deep and 200 feet wide, and was subsequently modified to make the depth 26 feet and width of 800 feet in Bay Ridge channel and 400 feet in Red Hook channel. This was completed in 1899 at a cost of about $1,090,000.

The existing project was adopted by the river and harbor act of 1899, which provided for making Bay Ridge and Red Hook channels 40 feet deep at mean low water and 1,200 feet wide. The work was authorized to be done under a continuing contract at a cost not exceeding $2,500,000, of which $491,000 remains to be appropriated. Such a contract was entered into in 1899 for excavating about 22,000,000 cubic yards of material and completing the project. Work was begun in 1900 and prosecuted until November, 1906, generally at rates of progress less than required by the original contract. November 24, 1906, the last of the dredges was withdrawn from the work; the plant had been sold by the contractors, and the new owners refused to continue dredging. The contractors failed to resume work when called upon, and the contract was annulled February 20, 1907.

The river and harbor act approved March 2, 1907, authorized the prosecution of the improvement of these channels with a view to obtaining first a depth of 35 feet and subsequently the full depth of 40 feet and width of 1,200 feet, in accordance with the project adopted in 1899. A new contract for continuing work under the project with the funds available was thereupon entered into in 1907 and completed in April, 1909.

Under this later project, up to June 30, 1909, $1,615,435.93 has been expended in dredging 14,449,116 cubic yards of sand and mud, which is about 66 per cent of the amount estimated to complete the project. In its present condition Bay Ridge channel has an available depth of 35 feet at mean low water, with width of 1,000 to 1,060 feet, except at the arm toward Gowanus Creek, where the harbor lines converge. Red Hook channel has 30 feet available depth for a width of 1,000 feet.

The total length of channel covered by the improvement is 4½ miles; the mean rise of tide is 4½ feet.

During the year ending June 30, 1909, 799,727 cubic yards of sand and mud were dredged, widening Bay Ridge channel, removing shoals, and extending it to its junction with Gowanus Creek, and in widening Red Hook channel to 1,000 feet width and 30 feet depth.

With funds now available, a contract is about to be entered into for widening Bay Ridge channel to 1,200 feet, with 35 feet depth; widening Red Hook channel to 1,200 feet, with 30 feet depth, and deepening the latter to 35 feet for such width as is practicable with the funds, estimated about 350 feet. Future appropriations will be applied to deepening Bay Ridge channel to 40 feet and to widening the 35-foot depths in Red Hook channel to 1,200 feet width and to making the channel 40 feet deep, the dimensions contemplated in the project adopted by Congress.

Since the failure of the original contract for completion of the present project it has been evident that no prices can be obtained which would permit of completing the whole within the limit of authority of 1899. A survey has been made upon which a new estimate for completion has been prepared, amounting to $1,450,000.

The commerce of this part of the port of New York consists of coffee, sugar, cotton, coal, and miscellaneous freights, chiefly from foreign ports. In 1908 it amounted to approximately 4,287,900 tons, of an estimated value of $221,488,000.

Further details concerning these channels are contained in the Annual Report of the Chief of Engineers for 1899, page 1266.

House Document No. 337, Fifty-fourth Congress, second session, contains a report upon a survey of these channels, with map showing locations and depths as existing in 1897. (See Annual Report of the Chief of Engineers for 1897, p. 1177.)

The effect of the improvement projected is undoubtedly to lower freight rates; these rates depend so largely upon the amount of business in hand and upon competition that it is impracticable to separate the effect of the improvement upon rates. A notable effect has been the growth of foreign commerce and the class of ships which carry it, many of which could not have entered Bay Ridge channel before its improvement.

July 1, 1908, balance unexpended	$262,361.01
Amount appropriated by sundry civil act approved March 4, 1909	310,000.00
	572,361.01
June 30, 1909, amount expended during fiscal year, for works of improvement	178,769.14
July 1, 1909, balance unexpended	393,591.87
July 1, 1909, outstanding liabilities	45,970.20
July 1, 1909, balance available	347,621.67
Amount (estimated) required for completion of existing project	1,450,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	315,000.00

(See Appendix F 2.)

3. *Enlargement of Governors Island, New York Harbor, New York.*—The project for this entire work, adopted under the terms of the sundry civil act of 1901, which made appropriations for beginning operations, included an addition of about 82 acres to the area of the island by inclosing with a bulkhead part of the shoal southwest of the island and filling the inclosure, the building of a wharf on the north shore and dredging to a depth of 26 feet in front of the wharf, and the erection of buildings. The work of enlargement, including construction of a wharf and dredging, all estimated to cost $1,100,000, was assigned to the Engineer Department. By a modification of

the project adopted in April, 1902, the enlargement was to be extended southwest over the shoal to reclaim an additional area of about 19 acres, making the total area of the enlargement about 101 acres. This may necessitate an increase in the estimate of cost to cover this work, and construction of about 600 feet of sea wall around it, and the preparation of the sand embankment for growing grass by covering it with clay and loam; but the amount can not be definitely stated pending a determination of the details of the plan.

Work was begun in August, 1901, and up to June 30, 1909, $885,248.90 has been expended.

During the fiscal year 1,124,388 cubic yards of filling material was delivered in the inclosure, of which 638,339 yards were placed above mean low water in the embankment, under a contract completed in June, 1909; minor repairs were made to the sea wall; and a light and fog bell were maintained at the southwest curve of the sea wall.

The entire work done to June 30, 1909, consists in building a pile wharf, with a T head, 370 feet long, dredging the approaches 26 feet deep, laying intercepting sewers, building 6,795 linear feet of riprap bulkhead to inclose the area of enlargement, and upon the bulkhead building 6,775 linear feet of masonry sea wall, and in building an embankment to cover 80 acres above low water.

The sea wall is completed, except a gap of 350 feet clear width, left to permit bringing in material for the embankment.

The available funds will be applied to completing sea wall and embankment construction.

July 1, 1908, balance unexpended	$328, 287. 53
Amount appropriated by sundry civil act approved March 4, 1909	75, 000. 00
	403, 287. 53
June 30, 1909, amount expended during fiscal year for works of improvement	188, 533. 83
July 1, 1909, balance unexpended	214, 753. 70

(See Appendix F 3.)

4. Removing sunken vessels or craft obstructing or endangering navigation—Wreck of steamship Finance.—This ship, belonging to the Panama Steamship Company, sunk November 26, 1908, north of Bayside channel, as result of a collision in a dense fog.

The wreck was marked with a gas buoy during winter, and when the season made work in this locality practicable a contract was entered into for removal of the wreck for the sum of $23,950, under which work is in progress.

Wreck of steamship Daghestan.—This British ship, outward bound, collided with another ship on December 18, 1908, and after floating several hours sunk in 65 feet of water about 3 miles outside the harbor entrance. The obstruction was marked with gas and bell buoys.

On May 28 a contract was entered into for removal of so much of the wreck as necessary to make a clean depth over it of 50 feet at mean low water, for the sum of $33,700.

Removal is about to begin.

Wreck of barge Wm. H. Connor.—This barge, in tow, collided with a schooner near the entrance to the harbor on or about April 22, 1909;

she was towed to the edge of the channel and grounded in 22 feet of water.

A contract for her removal is about to be made at cost of $3,000.

The total amount expended during the fiscal year for the removal of wrecks was $129.45.

(See Appendix F 4.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE THIRD NEW YORK, NEW YORK, DISTRICT.

This district was in the charge of Col. D. W. Lockwood, Corps of Engineers, division engineer, eastern division.

1. *Passaic River, New Jersey.*—This river is a stream of considerable size, rising among the highlands in the northern part of New Jersey and flowing in a generally easterly and southerly course into Newark Bay. It is navigable from its mouth to Passaic, a distance of about 16 miles, where navigation is cut off by the Dundee Water Power and Land Company's dam. In its natural condition the navigable depth to Newark was about 7 feet at mean low water; from Newark to Passaic it was about 3 feet.

The first project for improvement, adopted by the river and harbor act of June 10, 1872, was for providing a channel, by diking and dredging, from Newark to Passaic from 6 to 7½ feet deep and from 50 to 200 feet wide, the first cost being estimated at $123,924. This was subsequently increased to $193,822.

The second project was for improving the river below Newark and was authorized by the river and harbor act of June 14, 1880, at an estimated cost of $353,875. It proposed a channel 200 feet wide and 10 feet deep at mean low water up to Center Street Bridge, Newark.

The two projects were consolidated by the river and harbor act of July 13, 1892, the estimated cost of the improvement being $547,697.

The amount expended under this consolidated project up to the close of the fiscal year ending June 30, 1909, was $499,779.68, of which $389,610 was used in carrying out the projects and $110,169.68 for maintenance.

Existing projects: That adopted by the act of June 13, 1902, in accordance with the report submitted in House Document No. 401, Fifty-sixth Congress, first session, provides for making a channel from Staten Island Sound through Newark Bay and the said river to the Montclair and Greenwood Lake Railroad bridge 12 feet deep to the Nairn Linoleum Works, and 10 feet deep from that point to the said railroad bridge, a total distance of 10.8 miles. The estimated cost was originally $296,000, but was subsequently increased, additional funds having been appropriated by the river and harbor act of March 3, 1905, and may now be stated at $323,274.60. Work under this project was authorized to be done under continuing contracts, the total amount of the contract authorization being now appropriated. The yearly cost of maintenence is estimated at $10,000. The amount expended on this project up to the close of the fiscal year ending June 30, 1909, was $279,822.63.

By the passage of the river and harbor act approved March 2, 1907, a project has been adopted which provides for making a channel 16 feet deep at mean low water, 300 feet wide from deep water in Newark

Bay to the Nairn Linoleum Works, 9.7 miles, thence 200 feet wide to the Montclair and Greenwood Lake Railroad bridge, 1.1 miles, in accordance with the report submitted in House Document No. 441, Fifty-ninth Congress, second session, estimated to cost $1,216,775. The act provides for an expenditure of $850,000 for prosecuting the work, of which $385,000 is yet to be appropriated under continuing-contract authorization. The amount expended on this project to the close of the fiscal year ending June 30, 1909, was $262,775.40.

The projects of 1902 and 1907 for the lower part of the river include or supersede the part of the old project below Newark, but leave in force the part above Newark which is included between the Montclair and Greenwood Lake Railroad bridge and the city of Passaic, a distance of 6 miles, as stated under head of "first project" above. Up to June 30, 1909, $209,953.14 had been expended on this part of the project, of which $150,734 was expended for the project and $59,219.14 for maintenance work. The annual cost of maintenance is estimated at $5,000. This project is practically completed, a depth of 6 feet at mean low water and width of about 100 feet having been obtained.

During the past fiscal year dredging has been carried on under three contracts:

1. Under project of June 13, 1902, operations consisted in dredging under a continuing contract with P. Sanford Ross (Incorporated), 86,547 cubic yards of material being removed. Work was in progress at the beginning of the year, and the contract was completed on December 5, 1908, when the total amount of material removed was 707,897 cubic yards.

2. Under project of June 13, 1902, operations consisted in dredging under contract with the International Contracting Company, 2,468 cubic yards of material being removed. Work was in progress and contract nearly completed at the beginning of the year. The contract was completed on July 8, 1908, when the total amount of material removed was 157,502 cubic yards.

Channels of 12 feet depth and 200 feet in width have been completed from Newark Bay to the Nairn Linoleum Works, and of 10 feet depth and about 200 feet width to the Montclair and Greenwood Lake Railroad bridge. This project is nearly completed. There remains a little widening to be done just below the said railroad bridge.

3. Under project of March 2, 1907, operations consisted in dredging under a continuing contract. Dredging was in progress at the beginning of the year, at which time 779,708 cubic yards of material had been removed from Newark Bay and Passaic River, and the 16-foot channel had been carried through the bay and lower end of the river with width of about 150 feet for an aggregate distance of about 4 miles. Dredging was continued through the year, and 1,069,748 cubic yards of material were removed. The 16-foot channel was widened and nearly extended to the Center Street railroad bridge, Newark, a distance of about 8 miles from the beginning of the work in Newark Bay, with widths of from 150 to 200 feet.

The maximum drafts that could be carried June 30, 1909, were as follows: Sixteen, 12, and 10 feet, as above stated, below the Montclair and Greenwood Lake Railroad bridge, and 6 feet from that bridge to the city of Passaic. Mean range of tides: At mouth of river, 4.7 feet, and at Passaic, 2.5 feet.

It is proposed to apply the available balance and the amount estimated as a profitable expenditure to continuation and maintenance of the improvement in accordance with the adopted projects.

The commerce of this river is mainly in building material, iron ore, fertilizers, coal, and general merchandise, and amounted to 2,037,363 tons in 1900, to 2,009,356 tons in 1901, to 2,494,312 tons in 1902, to 2,356,511 tons in 1903, to 2,567,942 tons in 1904, to 2,567,000 tons in 1905, to 2,577,188 tons in 1906 and 1907, valued at $167,113,305, and in 1908 to 2,110,959 tons, valued at $171,612,700, including the commerce of Hackensack River, which passes through Newark Bay. Tonnage reported heretofore in gross tons; reported this year in short tons.

This improvement is necessary to the great industrial interests, and has reduced freight rates $1 a ton on coal and building materials, and its continuance is necessary to the successful carrying on of the business of this locality.

Details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, pages 770–774, and for 1900, pages 177, 1530–1550.

Reference to reports of examinations and surveys is noted in the Annual Report of the Chief of Engineers for 1907, page 156. Report upon preliminary examination of Newark Bay, ordered by river and harbor act approved March 3, 1909, was made on April 23, 1909.

Maps showing mouth of river and Newark Bay are printed in the Annual Reports of the Chief of Engineers for 1882, page 686, and 1887, page 766, and maps of the river in the vicinity of and above Newark are printed in House Document No. 401, Fifty-sixth Congress, first session, and of the full length of the bay and river under improvement in the Annual Report of the Chief of Engineers for 1905, page 1030.

July 1, 1908, balance unexpended		$292,123.25
Amount appropriated by sundry civil act approved March 4, 1909		200,000.00
Received from sale of maps during the year		30.30
		492,153.55
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$192,069.71	
For maintenance of improvement	2.60	
		192,072.31
July 1, 1909, balance unexpended		300,081.24
July 1, 1909, outstanding liabilities		55,194.01
July 1, 1909, balance available		244,887.23
July 1, 1909, amount covered by uncompleted contracts		378,243.77
Amount (estimated) required for completion of existing project		751,775.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for work of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.		150,000.00

(See Appendix G 1.)

2. Arthur Kill, or Staten Island Sound, and channel between Staten Island and New Jersey.—(a) Arthur Kill, or Staten Island Sound, New York and New Jersey.—This is a waterway about 12 miles long, which, together with the lower end of Newark Bay, 2 miles long, and the Kill van Kull, 3 miles long, forms the inland waterway between upper New York Harbor and Raritan Bay. The section now contemplated under this improvement consists of the 14 miles of channel between Kill van Kull and Raritan Bay. The original depth through the Arthur Kill, or Staten Island Sound, at mean low water was 15 feet and upward, in a channel 100 to 1,000 feet in width. Through the lower end of Newark Bay the navigable channel depth was about 14 feet at mean low water, the result of an improvement commenced in 1874 and continued up to the present time. In the present project the new channel was cut through the flats to the southward of the original channel on which the depth was 1 to 2 feet at mean low water.

Projects: Sections of this waterway have been under improvement by the United States under the titles of "Channel between Staten Island and New Jersey," adopted in 1880, superseding the project of 1874, and "Arthur Kill," adopted in 1888. The former provided for a depth of 14 feet and width of 400 feet through the lower part of Newark Bay, and the latter for the removal of Steep Point, in order to straighten the channel to the southwestward of the Baltimore and Ohio Railroad bridge.

Details and references as to these projects are printed in current report under the head of "Channel between Staten Island and New Jersey," which project is still in force.

The existing project for this improvement, adopted by the river and harbor act approved June 13, 1902, provides for making and maintaining a channel from Kill van Kull to Raritan Bay, New York and New Jersey, by means of dredging and diking, 300 feet wide and 21 feet deep at mean low water, at an estimated cost of $696,000, and $5,000 for annual cost of maintenance. Work under this project is authorized to be done under continuing contracts, $91,000 of the authorization still remaining to be appropriated. The amount expended on the project to June 30, 1909, was $446,924.43; of this amount $22.10 was derived from the sale of maps.

Operations during the past fiscal year consisted in dredging, under a continuing contract, approved by the Department on October 27, 1903, upon which work was commenced on December 2, 1903. During the year 593,926 cubic yards of material were removed from several sections of the channel between Shooters Island and Carteret. About six-sevenths of the dredging contemplated by this project has been completed, and the 21-foot channel has been dredged through the waterway, with widths of about 300 feet. Shoaling in the upper part of the channel, particularly in the vicinity of Corner Stake light, has reduced the depth to about 18 feet at mean low water. This will be redredged under contract in force and in progress.

The maximum draft that could be carried through the waterway on June 30, 1909, was 18 to 20 feet at mean low water. Mean range of tides, 5 feet.

It is proposed to apply the amount estimated as a profitable expenditure to rock removal in continuing the improvement and to dredging for maintenance in accordance with the adopted project.

The freight carried through this waterway consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1900 to 11,047,633 tons, in 1901 to 11,651,300 tons, in 1902 to 14,517,079 tons, in 1903 to 11,512,420 tons, in 1905 to 11,721,861 tons, valued at $265,193,813, in 1906 to 16,574,840 tons, valued at $355,579,817, in 1907 to 14,948,077 tons, valued at $245,032,666, and in 1908 to 15,995,231 tons, valued at $239,395,113. Tonnage reported heretofore in gross tons; reported this year in short tons.

It appears from inquiry that no estimate can be made of the exact effect of the project on freight rates, except to the local commerce. The rates on this have been reduced by this improvement, and will be further reduced when the improvement has advanced to the extent of providing a practicable navigable channel of 21 feet.

References to reports of examinations and surveys are noted in the Annual Reports of the Chief of Engineers for 1904, page 137, and for 1907, pages 157 and 158.

Report on preliminary examination of Arthur Kill at the westerly side of Buckwheat Island is printed in House Document No. 533, Sixtieth Congress, first session, and in Annual Report of the Chief of Engineers for 1906, page 167.

Maps of this work are printed in House Document No. 393, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1905, page 1034.

July 1, 1908, balance unexpended		$113,558.05
Amount appropriated by sundry civil act approved March 4, 1909		150,000.00
Received from sale of maps during the year		5.80
		263,563.85
June 30, 1909, amount expended during fiscal year for works of improvement		105,465.48
July 1, 1909, balance unexpended		158,098.37
July 1, 1909, outstanding liabilities		31,365.00
July 1, 1909, balance available		126,733.37
July 1, 1909, amount covered by uncompleted contracts		83,982.94
Amount (estimated) required for completion of existing project		91,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$30,000.00	
For maintenance of improvement	10,000.00	
		40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*b*) *Channel between Staten Island and New Jersey.*—This channel is an inland waterway, about 17 miles long, connecting New York Harbor with Raritan Bay. It consists of the Kill van Kull, connecting the upper bay with Newark Bay, and the Arthur Kill, connecting Newark Bay with Raritan Bay.

The natural depth through the channel was 15 feet or more, except for a distance of about 1¾ miles in Newark Bay, where there was a shoal with a crooked channel 9½ feet deep, bordered by flats with depth of about 2 feet of water. The improvement of the "channel between Staten Island and New Jersey" consists in the deepening of the channel across this shoal.

The first project, adopted by the river and harbor act of June 23, 1874, was for making this channel from 14 to 16 feet deep, at an estimated cost of $443,211. The only work done under it was the building of 2,237 linear feet of diking, at a cost of $50,000.

The second and existing project was adopted in 1880, which, with subsequent modifications, proposed to dredge through the shoal a channel 400 feet wide and 14 feet deep at mean low water, the cost being estimated at $210,000.

A supplemental project was adopted by the river and harbor act of August 11, 1888, which had for its object the removal of the point of land known as "Steep Point," for the straightening of the channel to the westward of the Baltimore and Ohio Railroad bridge. This work was carried on under the title of "Improvement of Arthur Kill, New York and New Jersey," 1888–1895. The cost was estimated at $26,500, and the work was completed in 1895, at a cost of $25,401.30. This modification of the project brought the total cost of the improvement up to $286,500.

The river and harbor acts of June 3, 1896, and June 13, 1902, extended the project to include the dredging of a channel in Lemon Creek, on Staten Island, at a cost of $5,000 and $5,000, respectively.

This extension increased the total estimated cost of the improvement from the beginning to $296,500. Annual maintenance is estimated at $10,000.

The total amount expended to June 30, 1909, on the project, with its additions and modifications, was $308,829.84, which was applied to diking, to dredging a channel 14 feet deep and 400 feet wide through the shoal in Newark Bay, to removing Steep Point, and to dredging a channel in Lemon Creek 8 feet deep at high water and from 35 to 50 feet wide; $206,635.08 has been expended in carrying out the project and $102,194.76 for maintenance. The work contemplated under this project has been completed.

No work was done during the fiscal year, the expenditure being for expenses connected with harbor line hearing; the channel was reported to be in good condition, the result of dredging in the seasons of 1906–7.

It is proposed to apply the available balance and the amount recommended as a profitable expenditure to the maintenance of the improvement.

The maximum draft that could be carried June 30, 1909, through the channel between Staten Island and New Jersey was about 14 feet at mean low water, and in Lemon Creek about 6 feet at mean high water to the head of navigation, a distance of about one-half mile from the mouth. Mean range of tides, 5 feet.

The freight carried through this channel consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1901 to 11,651,300 tons, in 1902 to 16,266,574 tons, in 1903 to 14,129,678 tons, in 1905 to 14,339,120 tons, valued at $325,625,465, and in 1906 to 17,097,799 tons, valued at $396,266,084. No report has been received since 1906. A part of the commerce now passes through the new "Arthur Kill channel," which has been dredged south of the old channel and Corner Stake light.

The commerce of Lemon Creek as given by the last report in 1907 has an estimated value of $435,000; number of vessels in use, 50 to 75, draft 3½ to 6 feet, with a valuation of $145,000.

This is a connecting channel and no estimate can be made of the exact effect on the rates of freight, but it is known that the present commerce could not be carried on without this improvement.

Further details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1887, Part 1, page 743; for 1890, page 843; for 1896, page 775; for 1897, pages 1130–1132, and for 1900, page 1525.

Reference to reports on examinations and surveys are noted in the Annual Report of the Chief of Engineers for 1907, page 160.

Maps of this improvement are printed in the Annual Reports of the Chief of Engineers for 1881, page 696; 1889, pages 820–822; 1890, page 844, and 1905, page 1036, and in House Document No. 393, Fifty-sixth Congress, first session. Map of Lemon Creek is printed in the Annual Report of the Chief of Engineers for 1905, page 1036.

July 1, 1908, balance unexpended	$2,703.56
June 30, 1909, amount expended during fiscal year for maintenance of improvement	33.40
July 1, 1909, balance unexpended	2,670.16
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

CONSOLIDATED.

July 1, 1908, balance unexpended		$116,261.61
Amount appropriated by sundry civil act approved March 4, 1909		150,000.00
Received from sale of maps during the year		5.80
		266,267.41
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$105,465.48	
For maintenance of improvement	33.40	
		105,498.88
July 1, 1909, balance unexpended		160,768.53
July 1, 1909, outstanding liabilities		31,365.00
July 1, 1909, balance available		129,403.53
July 1, 1909, amount covered by uncompleted contracts		83,982.94
Amount (estimated) required for completion of existing project		91,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$30,000.00	
For maintenance of improvement	30,000.00	
		60,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix G 2.)

3. *Woodbridge Creek, New Jersey.*—This creek is a small, crooked tidal stream, about 5 miles long, running through flat marshes for most of its length and emptying into the west side of Arthur Kill, or Staten Island Sound, 2 miles north of Perth Amboy, N. J.

It is navigable for 2⅜ miles above the mouth to a point where it is crossed by a highway bridge without a draw. The width of the creek below this bridge is about 100 feet. In its original condition this stream was obstructed at its mouth by a bar having a least depth of 9.8 feet at high water, and by two shoals just inside the mouth. From these shoals a good 12-foot channel existed to above Anderson's brickworks, seven-eighths of a mile from the mouth, above which point, however, many shoals occurred, although a narrow 8-foot channel existed as far as Salamander dock, 1⅞ miles from the mouth.

First project: A survey of the navigable part of this creek was made in 1878, reference to which is made on page 139 of the Annual Report of the Chief of Engineers for 1904, and a project for its improvement was adopted by the river and harbor act of March 3, 1879. This project provided for forming a channel 12 feet deep at mean high water and 80 feet wide from the mouth of the creek to the Salamander dock at an estimated cost of $13,800, which amount was increased in 1884 to $29,000. Work on this improvement was carried on under appropriations made from 1879 to 1882, amounting to $19,000, which was expended without completing the project, and was suspended in 1883, and in 1900 the channel had relapsed to its original condition.

The existing project, adopted by the river and harbor act of June 13, 1902, contemplates obtaining a channel 8 feet deep at mean low water, with a bottom width of 50 feet, by dredging, from Arthur Kill to Salamander dock, at an estimated cost of $35,000 for the improvement and $3,000 annually for maintenance. Reference to this project, and of the examination and survey upon which it is based, is contained in the Annual Report of the Chief of Engineers for 1904, page 139.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $42,329.64, of which $30,822.70 was used in carrying out the project and $11,506.94 for maintenance. No work was done during the fiscal year. Project for the expenditure of the allotment of $6,000 for maintenance, act of March 3, 1909, was approved March 19. The work was advertised, and proposals were opened on June 8. A contract for dredging was in course of preparation at the close of the year. At the close of the last work, January, 1908, the channel was practically restored to proposed dimensions and the project completed. Expenditures were for office expenses and contingencies.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the channel was 6 to 7 feet at mean low water. The mean range of tides is 5 feet.

The commerce of this creek, mainly in clay, brick, tile, coal, tin scrap, steel scrap, and building materials, amounted in 1887 to 126,000 tons, in 1898 to 176,000 tons, in 1903 to 155,751 tons, in 1904 to 165,313 tons; in 1905 to 160,194 tons, valued at $1,018,198; in 1906 to 167,392 tons, valued at $1,128,237; in 1907 to 151,671 tons, valued at $1,071,548; and in 1908 to 163,120 tons, valued at $791,700. Tonnage heretofore reported in gross tons; reported this year in short tons.

It appears from inquiry that freight rates have been reduced as a result of this improvement.

It is proposed to apply the sum estimated as a profitable expenditure to maintenance of improvement.

Maps of the creek are printed in House Document No. 282, Fifty-sixth Congress, first session, and in Annual Report of the Chief of Engineers for 1905, page 1036.

July 1, 1908, balance unexpended	$928.16
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	6,000.00
	6,928.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	507.80
July 1, 1909, balance unexpended	6,420.36
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	6,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix G 3.)

4. *Raritan Bay, New Jersey.*—This bay is a large body of water lying between the southern end of Staten Island and the New Jersey shore. Its greatest width north and south is about 5 miles and its greatest length east and west is about 7 miles. The Raritan River empties into it at its west end, between Perth Amboy and South Amboy, and the Arthur Kill, or Staten Island Sound, extends northward, connecting it with Newark Bay.

This bay had naturally a fairly straight channel, 11 feet deep, to South Amboy. The line of the deepest water, however, followed the Staten Island shore from Perth Amboy to Seguine Point, where it was separated from deep water in the eastern part of the bay by a shoal 1.5 miles broad, with a minimum depth of 14.5 feet.

The original and existing project, adopted March 3, 1881, and extended September 19, 1890, and June 3, 1896, provides for dredging channels 300 feet wide and 21 feet deep from Seguine Point to deep water in the bay, a distance of about 1.5 miles, through two shoals opposite Wards Point, 0.4 and 0.6 mile long, respectively, and from South Amboy to deep water near Great Beds light, a distance of about 1.5 miles. The estimated cost of the work is $507,875.

Reference to reports on examinations and surveys are noted in the Annual Report of the Chief of Engineers for 1904, pages 140 and 1158.

The amount expended on the work up to the close of the fiscal year ending June 30, 1909, was $560,954.53, of which $297,314.45 was used in carrying out the project and $263,640.08 for maintenance. Of this amount $3 was derived from the sale of maps. The project has been completed, and the only work now contemplated is maintenance of the improvement.

Operations during the fiscal year consisted in dredging under contract for maintenance. Work was in progress at the beginning of the fiscal year, and was continued until August 1, when the contract was completed. The amount of material dredged during the year was 48,936 cubic yards, making the total amount removed under the contract 105,990 cubic yards.

Project for expenditure of the allotment of $20,000, act of March 3, 1909, was approved on March 19. Examinations of the channels were made, and preparation of specifications for maintenance dredging was in progress at the close of the year.

It is proposed to apply the amount recommended as a profitable expenditure for maintenance.

The maximum draft that could be carried June 30, 1909, through the Wards Point, South Amboy, and Seguine Point channels was about 20 feet at mean low water. Mean range of tides, 5 feet.

The commerce of the bay is mainly in coal, brick, refined lead and copper, bullion, clay products, and general merchandise, and amounted in 1901 to 4,722,048 tons, in 1902 to 5,453,122 tons, in 1903 to 4,484,152 tons, in 1905 to 5,296,986 tons; in 1906 to 6,432,245 tons, valued at $114,358,610; in 1907 to 7,424,414 tons, valued at $139,228,344; and in 1908 to 8,729,748 tons, valued at $136,550,115. Tonnage heretofore reported in gross tons; reported this year in short tons.

It appears from statements of the shipping interests of the great railroad terminals that the improvements have resulted in a great reduction of towing rates and a proportionate reduction of freight rates, owing to the greater quantity of coal that can be carried and towed through these channels over that which was carried before the improvement was made.

Further details of this improvement are printed in the Annual Report of the Chief of Engineers for 1896, pages 787–789. Maps are printed in the Annual Report of the Chief of Engineers for 1905, page 1038.

July 1, 1908, balance unexpended	$24,787.52
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	20,000.00
	44,787.52
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	23,239.05
July 1, 1909, balance unexpended	21,548.47
July 1, 1909, outstanding liabilities	4.80
July 1, 1909, balance available	21,543.67
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix G 4.)

5. *Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, Shoal Harbor and Compton Creek, and Cheesequake Creek, New Jersey.*—(*a*) *Keyport Harbor.*—This harbor is situated at the mouth of Matawan Creek, on the south side of Raritan Bay, 5 miles east of the mouth of Raritan River, and it consists of a bay about 1 mile broad.

There was no distinct natural channel in the harbor, the available depth to the wharves being less than 4 feet at mean low water. A 6-foot channel had been dredged at private expense before the United States assumed charge of the improvement, but it had shoaled again to 3 feet.

The original and existing project, approved August 2, 1882, with subsequent modifications (1884), contemplates dredging a channel 8 feet deep at mean low water about 4,700 feet long and 200 feet wide from Raritan Bay to the steamboat dock at Keyport, at an estimated cost of $40,475. Reference to report on examination and survey is noted in the Annual Report of the Chief of Engineers for 1904, page 141.

The amount expended to June 30, 1909, was $68,197.39, of which sum $30,500 was used in carrying out the project and $37,697.39 for maintenance. A channel of the required length and nearly the proposed width was completed in 1883–84. Recent appropriations have been insufficient to maintain projected dimensions. The improvement may now be considered as about half completed.

Under an allotment of $8,705.97 from the consolidated appropriation, act of March 2, 1907, a contract for dredging was in force and preparations for beginning work were in progress at the beginning of the year. Dredging was commenced on July 9, and the contract was completed on August 26. The amount of material removed was 19,878 cubic yards. The channel was restored to 100 feet width and 8 feet depth for about one-half its length. The remainder of the channel had a depth of about 7 feet at mean low water.

The maximum draft that could be carried June 30, 1909, to the Keyport wharves was about 7 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this harbor is mainly in farm products, fertilizers, coal, lumber, fish, shellfish, and miscellaneous freight, and amounted to 67,500 tons in 1899, to 45,000 tons in 1901, to 62,000 tons in 1903, to 70,000 tons in 1904, to 86,821 tons in 1905, valued at $2,202,105, in 1906 to 229,377 tons, valued at $3,074,060, including the commerce of Matawan Creek, in 1907 to 160,925 tons, valued at $3,275,305, and in 1908 to 123,724 tons, valued at $3,146,800. Tonnage reported heretofore in gross tons; reported this year in short tons.

The effect of this improvement has been to greatly reduce freight rates, especially in the marketing season.

It is proposed to apply the available balance, and the amount estimated as a profitable expenditure, for the completion and maintenance of the improvement in accordance with the adopted project.

Further details as to this work are printed in the Annual Report of the Chief of Engineers for 1897, pages 1147–1148. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1040.

July 1, 1908, balance unexpended	$9,662.14
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	5,000.00
	14,662.14
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	8,678.56
July 1, 1909, balance unexpended	5,983.58
Amount (estimated) required for completion of existing project	9,975.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]

---

[a] See consolidated money statement on page 183.

(*b*) *Matawan Creek.*—This creek is a small tidal stream in the eastern part of New Jersey which discharges into Raritan Bay at Keyport Harbor. It is navigable up to the bridge of the New York and Long Branch Railroad, about 2 miles above its mouth.

In its natural condition the mouth was obstructed by a mud flat, through which a narrow and crooked 3-foot channel existed. Above this flat there was a 4-foot channel for a mile and beyond a narrow 3-foot channel extending nearly up to the head of navigation at Matawan.

The original and existing project for improving this stream, by dredging a 4-foot channel 100 feet wide from the mouth to Winkson Creek, about 1 mile, and thence 75 feet wide to the railroad bridge at Matawan, was adopted March 3, 1881. The cost was estimated at $33,120. Reference to report on examination and survey is noted in the Annual Report of the Chief of Engineers for 1904, page 141.

The amount expended to June 30, 1909, was $56,480.31, of which $21,000 was used in carrying out the project and $35,480.31 for maintenance. About two-thirds of the work proposed under the project has been completed, and a channel has been dredged the required distance with widths of 50 to 100 feet, but this channel has greatly deteriorated.

Dredging under contract was in progress at the beginning of the year, at which time 1,258 cubic yards of material had been removed near the mouth of the creek. The contract was completed on August 26. The total amount of material, mud and sand, removed in maintenance work during the fiscal year was 7,036 cubic yards. The total amount dredged under the contract was 8,294 cubic yards.

Project for expenditure of the allotment of $3,000, act of March 3, 1909, was approved March 20. Dredging for maintenance was advertised and proposals were received on June 8, 1909, and at the close of the year a contract for the proposed work was in preparation.

The maximum draft that could be carried June 30, 1909, was about 3 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this creek is in brick and fireproofing, fertilizer, farm produce, and general merchandise, and amounted to 51,000 tons in 1899; to 60,000 tons in 1901; to 61,500 tons in 1903; to 29,600 tons in 1904; to 58,471 tons in 1905, valued at $203,955; in 1906 to 128, 181 tons, valued at $717,505; in 1907 to 40,900 tons, valued at $163,500; and in 1908 to 10,167 tons, valued at $38,265. Tonnage heretofore reported in gross tons; reported for this year in short tons.

The effect of this improvement has been to greatly reduce rates of freight, especially in the marketing season. Recent appropriations have been insufficient to maintain the channel in the upper part of the creek, where the market boats load.

It is proposed to expend the available balance and the amount estimated as a profitable expenditure for completion and maintenance of the project.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1145. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1042.

July 1, 1908, balance unexpended	$5,887.05
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	3,000.00
	8,887.05
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,562.97
July 1, 1909, balance unexpended	3,324.08
Amount (estimated) required for completion of existing project	12,120.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(c) *Raritan River.*—This river is a moderate-sized stream flowing through the central part of the State of New Jersey and emptying into Raritan Bay at Perth Amboy. It is navigable to New Brunswick, N. J., a distance of 12 miles, where it is the eastern terminus of the Delaware and Raritan Canal.

In its natural state the channel to New Brunswick was obstructed by several extensive shoals, on which the depth was from 6½ to 8½ feet at mean low water.

The sum of $13,963, appropriated in the years 1836 and 1837, was expended in removing obstructions from the river at New Brunswick.

The existing project for improvement, adopted June 18, 1878, with subsequent modifications, provides for a channel 200 feet wide and 10 feet deep from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, including a south channel between Crab Island and Kearney's dock, with a length of about 2½ miles, width of 100 feet, and depth of 5½ feet at mean low water, to be obtained by dredging, diking, and rock excavation, the cost being estimated at that time at $2,093,662. Recent and improved methods for doing such work have made it probable that this estimate will not exceed $1,035,000. Reference to reports on surveys with estimates is given in the Annual Report of the Chief of Engineers for 1907, page 166.

The amount expended upon the existing project up to the close of the fiscal year ended June 30, 1909, was $730,306.94, of which $659,192.32 was used in carrying on the work and $71,114.62 for maintaining that already done; of this amount $1.15 was derived from sale of condemned property. About two-thirds of the work contemplated under the project has been completed, and the following work has been accomplished under the project: A channel 10 feet deep has been made from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, the section through and below the reef at Whitehead's dock having a width of 200 feet and the section above the reef a width of 100 feet. South channel has been dredged to the projected depth and width for a length of about 4,000 feet. Five dikes have been built to maintain the channels.

No work was done during the fiscal year. At the close of the year contract for dredging for maintenance was in course of preparation under allotment of $10,000 from the appropriation made by the

---

[a] See consolidated money statement on page 183.

river and harbor act of March 3, 1909. Expenditures were for a survey of the south channel, as authorized, and for office expenses and contingencies.

At the close of work of 1908 the river was open to 10-foot navigation at low water.

It is proposed to apply the amount recommended as a profitable expenditure to continuing and maintaining the improvement.

On June 30, 1909, the maximum draft that could be carried to the head of navigation was 8 to 10 feet at mean low water. Mean range of tides: At mouth of river, 5.1 feet; at New Brunswick, 5.56 feet.

The commerce of this river is principally in coal, ores, refined copper, lumber, building materials, and general merchandise, and amounted in 1901 to 1,266,950 tons; in 1902, to 1,228,791 tons; in 1903, to 1,020,420 tons; in 1905, to 605,197 tons; in 1906, to 736,666 tons, valued at $17,377,645; in 1907, to 725,690 tons, valued at $32,678,472; and in 1908, to 918,302 tons, valued at $26,401,439. Tonnage heretofore reported in gross tons; reported for this year in short tons.

It appears from numerous letters received that this improvement has resulted in a very material reduction of freight rates.

Details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1892, page 881; for 1896, page 780; for 1897, page 1136; and further information is contained in the report for 1900, page 1505.

Maps of the river are printed in Annual Reports of the Chief of Engineers for 1885, page 760, and for 1905, page 1044.

July 1, 1908, balance unexpended	$835.77
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	10,000.00
	10,835.77
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	916.14
July 1, 1909, balance unexpended	9,919.63
Amount (estimated) required for completion of existing project	373,392.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]

(*d*) *South River.*—This is a small stream in the central part of New Jersey, which discharges into the Raritan River about 8 miles above its mouth. Before improvement by the United States a private canal about three-fourths of a mile long had been dredged from near Washington, on the South River, to Sayreville, on the Raritan River, which shortened the sailing course about 2 miles.

The depth in the canal was about 3.5 feet and in the river about 2.5 feet as far as Oldbridge, at the head of navigation, 6.3 miles above the canal.

The first project for this improvement was adopted March 3, 1871, and provided for dredging a channel 6 feet deep at mean low water up to the Washington wharves, at an estimated cost of $13,653. This was completed in 1874, at a cost of $20,000.

---

[a] See consolidated money statement on page 183.

The existing project, adopted June 14, 1880, provides for correcting the canal outlet and for obtaining, by dredging and diking, a channel 100 feet wide and 8 feet deep to Washington, 1.5 miles above the mouth; thence 6 feet deep to Bissetts, 3.7 miles above the mouth; thence 4 feet deep to Oldbridge, 6.3 miles above the mouth, at the head of navigation. The cost was estimated at $194,695, but was reduced in 1892 to $176,695. References to examinations and surveys are contained in the Annual Reports of the Chief of Engineers for 1904, page 143, and for 1907, pages 166 and 175.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1909, was $115,663.84, of which $89,336 was used in carrying on the work and $26,327.84 for maintenance. About one-half of the work contemplated under the project has been completed. Below the wharves at the village of South River or Washington a channel from 50 to 75 feet wide and 8 feet deep has been dredged and the projected dikes have been built. Above Washington the improvement accomplished is shown in report of work for fiscal year of 1908.

No work was done during the fiscal year. At the close of the year contract for dredging for maintenance was in course of preparation under allotment of $5,000 from the appropriation made by the river and harbor act of March 3, 1909. Expenditures were mainly for office expenses.

The maximum draft that could be carried to South River or Washington on June 30, 1909, was about 6 feet, thence to within 340 feet of Bissetts, 5 to 6 feet at mean low water. Mean range of tides: At canal, 5.34 feet; at Oldridge, 4.57 feet.

Large brickyards established along the banks of the river give it a commercial importance out of proportion to its size.

The commerce is principally in brick, sand, clay, coal, fertilizer, and general merchandise, and amounted in 1899 to 343,202 tons; in 1901, to 328,186 tons; in 1902, to 387,246 tons; in 1903, to 333,890 tons; in 1904, to 392,626 tons; in 1905, to 260,204 tons, valued at $1,046,208; in 1906, to 226,227 tons, valued at $972,550; in 1907, to 118,549 tons, valued at $477,530; and in 1908, to 99,197 tons, valued at $472,013. Tonnage heretofore reported in gross tons; reported for this year in short tons.

The improvement has caused a great reduction in freight rates, and it appears probable that the rates will be further reduced when the improvement reaches the upper stretches of the river. From reliable information received it appears that as a result of this improvement a reduction in freight rates on fire brick by rail to Boston of from $3.25 to $2 per ton has been made. The freight rate by rail to New York is $1.60 per ton; by water it is 75 cents per ton.

It is proposed to apply amount estimated as a profitable expenditure and the available balance to continuing and maintaining the improvement in accordance with the adopted project.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1896, pages 784–785.

Reference to preliminary examination and plan and estimate of cost of improvement of Old South River may be found in Annual Report of the Chief of Engineers for 1907, page 175.

Sketches of South River are printed in the Annual Reports of the Chief of Engineers for 1882, page 678; 1885, page 764, and 1905, page 1046.

July 1, 1908, balance unexpended	$751.91
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	5,000.00
	5,751.91
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	236.12
July 1, 1909, balance unexpended	5,515.79
Amount (estimated) required for completion of existing project	87,359.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*e*) *Elizabeth River*.—This is a small stream in the eastern part of New Jersey which discharges into the Arthur Kill at Elizabethport. Before improvement by the United States its width varied from 50 to 90 feet, and it had a high-water depth of 4 feet at the head of navigation at Broad street, Elizabeth, about 2¾ miles above its mouth.

The original and existing project, approved March 3, 1879, consists in dredging a channel 60 feet wide and 7 feet deep at mean high water, at an estimated cost, revised in 1881, of $43,160.

The amount expended on this work to June 30, 1909, was $59,648.87, of which $27,000 was used for carrying out the project and $32,648.87 for maintenance. About three-quarters of the work contemplated under this project has been completed. A channel 7 feet deep at mean high water and from 30 to 60 feet wide has been dredged from the mouth to Bridge street, Elizabeth.

Operations during the fiscal year consisted in dredging under contract for maintenance between Summer Street Bridge and the New York and Long Branch Railroad bridge, Elizabeth. Ten thousand seven hundred and twenty-three and three-tenths cubic yards of mud and silt were removed and the channel restored to width of 60 feet for a length of 3,540 feet.

The maximum draft that could be carried to Bridge street, Elizabeth, about one-fourth mile below the head of navigation at Broad street, on June 30, 1909, was about 5 feet at mean high water. A depth of 7 feet could be carried through the lower part of the river to Summer street. Mean range of tides: At mouth, 4.7 feet; at Bridge street, Elizabeth, 3.4 feet.

Under existing conditions as stated in the district officer's report for 1908, no further appropriation is recommended.

The commerce of the river is in coal, building materials, and miscellaneous freights. It amounted to 21,650 tons in 1895, to 28,865 tons in 1897, to 29,495 tons in 1901, to 40,250 tons in 1902, to 36,336 tons in 1904, to 28,887 tons in 1905, valued at $247,717; in 1906 to

---

[a] See consolidated money statement on page 183.

43,255 tons, valued at $352,784; in 1907 to 20,053 tons, valued at $87,322; and in 1908 to 31,825 tons, valued at $190,298. Tonnage reported heretofore in gross tons; reported this year in short tons.

It appears from statements received from shippers that there has been a reduction in freight rates, probably due to this improvement.

References to reports on examinations and surveys are noted in Annual Report of the Chief of Engineers for 1904, page 143.

Details in reference to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, page 778, and 1897, pages 1134 and 1185. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1048.

July 1, 1908, balance unexpended	$8,410.61
June 30, 1909, amount expended during fiscal year for maintenance of improvement	8,115.03
July 1, 1909, balance unexpended	295.58
Amount (estimated) required for completion of existing project	16,160.00

(*f*) *Shoal Harbor and Compton Creek.*—This harbor is on the south shore of Raritan Bay, 5 miles from Sandy Hook. Compton Creek is a narrow stream emptying into it. The natural harbor is inside the mouth of the creek, where the depth is from 3 to 6 feet at mean low tide. The creek is navigable for about 1 mile above its mouth, where it is crossed by a railroad bridge without a draw. One-fourth of a mile above its mouth it is crossed by a highway drawbridge.

The entrance to this harbor was originally obstructed by a broad flat shoal on which there was a depth of less than 1 foot at mean low tide, the distance between the deep water in the creek and the 4-foot depth in the bay being about one-half mile.

The original and existing project, adopted September 19, 1890, proposes a channel 4 feet deep connecting Compton Creek with Raritan Bay, the width to be 150 feet in the bay and 75 feet in and near the mouth of the creek, the channel through Shoal Harbor to be protected by a dike if necessary, at an estimated cost of $64,130.

The amount expended to June 30, 1909, was $45,502.81, of which sum $17,000 was applied to carrying out the project and $28,502.81 for maintenance. About three-fifths of the dredging contemplated under this project has been completed and a 4-foot channel 75 feet wide has been dredged through Shoal Harbor, connecting Raritan Bay with Compton Creek.

Nothing in furtherance of the improvement was done during the past fiscal year. The expenditure was for traveling expenses.

The maximum draft that could be carried June 30, 1908, in the improved channel through Shoal Harbor and Compton Creek to the drawbridge was 4 to 5 feet at mean low water. No soundings have been made this season. Mean range of tides, 4.5 feet.

The commerce of this locality in farm and fish products, fertilizers, and general merchandise amounted to 180,000 tons in 1901, to 48,790 tons in 1902, to 65,175 tons in 1903, to 28,570 tons in 1904, to 34,340 tons in 1905, valued at $1,198,200; in 1906 to 34,538 tons, valued at $1,167,920; in 1907 to 62,895 tons, valued at $1,809,380; and in 1908 to 82,262 tons, valued at $1,510,210. Tonnage heretofore reported in gross tons; reported for this year in short tons.

It appears from statements received from shippers that there has been a reduction on coal freights of 40 per cent, on manure from 40 to 50 per cent, and on fish 20 per cent, as a result of this improvement, and if the improvement is not continued the rates would be very much advanced.

Reference to report of examination and survey is noted in the Annual Report of the Chief of Engineers for 1907, page 169.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1150. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1050.

July 1, 1908, balance unexpended	$1,249.64
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1.88
July 1, 1909, balance unexpended	1,247.76
Amount (estimated) required for completion of existing project	47,130.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(g) *Cheesequake Creek.*—This is a small stream in the eastern part of New Jersey which discharges into Raritan Bay, about 2 miles east of South Amboy. Before improvement by the United States the available navigable depth in the creek was 1½ feet at mean low water over the shoals, the distance from the entrance to the upper limit of navigation being 3½ miles.

The existing project was adopted June 14, 1880, and provided for a new outlet, 5 feet deep, from the creek into Raritan Bay, at right angles to the shore line through a beach which put across the mouth of the creek from the right bank, and which had forced the outlet nearly one-half mile to the westward. This was to be obtained by dredging and constructing parallel jetties of stone, 200 feet apart, on each side of the dredged channel; the old outlet was to be closed by a pile dike, and a channel, 4 feet deep and from 50 to 100 feet wide, was to be dredged from the mouth to the head of navigation, 3½ miles up the creek. In this distance two dikes were to be built, and a new channel to be made through the marsh was to cut off a bend in the creek. Stump Creek, a tributary stream emptying into the creek near its mouth, was to be improved by dredging a channel 50 feet wide and 3 feet deep.

The cost was estimated at $75,279, which was revised in 1885 to $90,000.

Reference to survey and estimate are noted in the Annual Report of the Chief of Engineers for 1905, page 152.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1909, was $49,352.28, of which $40,000 was used in carrying out the project and $9,352.28 in maintenance. About four-ninths of the work contemplated under this project has

---

[a] At the time the estimates for the fiscal year ending June 30, 1911, were prepared and submitted to the Secretary of War, no item was included for Shoal Harbor and Compton Creek. After further consideration the district engineer officer recommends an estimate of appropriation for the year 1911 of $47,130 toward completing the improvement at this locality and $10,000 for maintenance.

been completed, and the work accomplished consists of the construction of the two parallel stone jetties at the mouth, the dredging of a 5-foot channel between them connecting the creek with the 5-foot curve in Raritan Bay, and the construction of the pile dike closing the old outlet.

During the fiscal year nothing in furtherance of the improvement was done; the channel has deteriorated but little since the last work in 1907.

The improvement has not advanced sufficiently to affect freight rates. It is proposed to expend the amount estimated as a profitable expenditure in continuing the work of improvement and for maintenance.

The maximum draft that could be carried through the mouth of the creek on June 30, 1909, was about 5 feet; mean range of tides, 5.1 feet.

The commerce of the creek is principally in fertilizer, sand, brick, clay, and farm produce, and amounted in 1886 to about 50,000 tons; in 1905 to 45,500 tons, valued at $146,050; in 1906 to 83,648 tons, valued at $625,000; in 1907 to 89,500 tons, valued at $263,100; and in 1908 to 79,520 tons, valued at $209,550. Tonnage heretofore reported in gross tons; reported for this year in short tons.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1886, page 763.

Sketches of Cheesequake Creek are printed in the Annual Reports of the Chief of Engineers for 1882, page 680, and in 1905, page 1051.

Amount (estimated) required for completion of existing project	$50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

CONSOLIDATED.

July 1, 1908, balance unexpended	$26,797.12
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	23,000.00
	49,797.12
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	23,510.70
July 1, 1909, balance unexpended	26,286.42
Amount (estimated) required for completion of existing project	596,136.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[b] 188,095.00

(See Appendix G 5.)

---

[a] See consolidated money statement on this page.

[b] At the time the estimates for the fiscal year ending June 30, 1911, were prepared and submitted to the Secretary of War no item was included for Shoal Harbor and Compton Creek. After further consideration the district engineer officer recommends an estimate of appropriation for the year 1911 of $47,130 toward completing the improvement at that locality and $10,000 for maintenance. Had these amounts been included with the others at the time when originally submitted, the total for the combined works in this consolidated item of appropriation would have been increased from $188,095 to $245,225.

6. *Shrewsbury River, New Jersey.*—This river is a large tidal basin in the eastern part of New Jersey, and consists of two bays, each having an area of about 3 square miles, and known, respectively, as the North Branch (or Navesink River) and the South Branch, and a channel called the main stem, which unites the two branches at their eastern ends and extends northwardly to the outlet at southeast end of Sandy Hook Bay. The river is navigable on the North Branch to Red Bank, 8 miles from the mouth, where it is crossed by three bridges without draws, and on the South Branch to Branchport, 9 miles from the mouth; also to Little Silver, Oceanport, Parkers Creek, North Long Branch, and Monmouth Beach, on the several arms of the South Branch.

The part of the river which has been under improvement by the United States consists of the main stem, the North Branch to Oceanic, 5 miles from the mouth, and the South Branch to the vicinity of Seabright, about 5½ miles from the mouth. The bays above Oceanic and Seabright had sufficient water to accommodate navigation.

Before any improvement was begun by the United States the available depth to Oceanic, on the North Branch, was 3½ feet, and to Seabright, on the South Branch, it was 2½ feet; the depth in the main stem was 4 feet. For details see Annual Report of the Chief of Engineers for 1886, page 756.

By act of Congress of August 30, 1852, $1,500 was appropriated for and expended upon a survey to ascertain the extent of a break through the beach between the Shrewsbury River and the ocean, but no work of improvement was begun.

First project: By act of Congress of July 11, 1870, a survey of the river was ordered. The report on this survey described a bar across the river nearly opposite the Navesink lights and four smaller bars above, and recommended deepening them by dredging, at an estimated cost of $14,000. The work was completed under appropriations amounting to $19,000, made in 1871 and 1873, and a new shoal near Lower Rocky Point was also dredged. The dredged channels did not long maintain the improved depth (6 feet at low tide).

Existing project, with modifications: The river and harbor act of 1875 provided for a survey of the "North and South branches of the Shrewsbury River, New Jersey." The project provided for dredging at Upper and Lower Rocky Point and a training dike at the entrance to the North Branch, at a total estimated cost of $18,000. This sum was appropriated by the river and harbor act of 1878, but before beginning the work it was decided to make a new and more detailed survey of the river. This survey was made in 1878, and the report presented a plan for improving both branches of the river and main stem to obtain a channel of 6 feet depth at mean low water, with a width of 300 feet in the main stem and of 150 feet in each of the branches, by dredging and constructing pile dikes or training walls. At this time the available depth in the main stem was found to be 5.4 feet at mean low water, in the North Branch 3.5 feet, and in the South Branch, at the entrance, 2.6 feet, practically suspending all navigation in the latter channel. The plan was referred to a Board of Engineers, and with slight modifications was approved by it February 12, 1879. It provided for the construction of seven pile dikes and for dredging at seven different shoal points, at a total estimated cost of $142,086. This project was adopted March 3, 1879. No essential modification of this project has since been made. Nine dikes have been built and the shoals have been dredged and redredged frequently in order to maintain the proposed depth of 6 feet. Owing to the change in diking and to the cost of dredging being generally greater than originally estimated, it was found necessary in 1881, 1883, and 1887 to add to the estimate for the completion of the whole work. The existing project for improvement, therefore, is the project of 1879, with the modifications indicated above, and proposes to secure a channel of 6 feet depth at mean low water, with width of 300 feet up to the junction of the North and South branches and with a width of 150 feet in those branches, by means of dredging and diking, at an estimated cost (including appropriation of 1878 applied to this project) of $234,062.

The sum expended under the existing project to the close of the fiscal year ending June 30, 1909, was $358,166.08, of which $195,393.95 was for carrying out the project, $157,772.13 for maintenance, and $5,000 for the survey made in 1903. Of the total amount expended, $1.25 was derived from sale of a map. The project is completed, dredging and dike repairs being required for maintenance of channels. Operations during the fiscal year consisted in dredging under contract for maintenance. The amount of material removed during the year was 36,404 cubic yards. At the close of work October 13, 1908, the channels had been practically restored to projected dimensions.

The maximum draft that could be carried June 30, 1909, throughout the limits of the improvement was 5 to 6 feet at mean low water. Mean range of tides: Outer bar, 5 feet; Highlands bridge, 3 feet; Seabright bridge, 1.3 feet.

The commerce of the river, mainly in coal, farm products, fertilizer, and general merchandise, amounted in 1889 to 906,000 tons; in 1902 to 657,000 tons; in 1903 to 761,000 tons; in 1904 to 780,290 tons; in 1905 to 1,768,500 tons, valued at $8,215,000; in 1906 to 1,668,500 tons, valued at $7,235,000; in 1907 to 1,718,125 tons, valued at $6,629,750; and in 1908 to 1,854,160 tons, valued at $6,270,000. Tonnage reported heretofore in gross tons; reported this year in short tons. The passenger traffic is important, the number of people carried by the Patten Line, South Branch, in 1902 being 264,635; in 1903, 277,257; in 1904, 266,157, and in 1905, 310,367.

It is proposed to apply the amount recommended as a profitable expenditure to maintenance of the improvement in accordance with the project.

It appears from reports received from the Merchants Steamboat Company and the New York and Long Branch Steamboat Company that freight rates have been lowered, and maintained, as results of the improvement by the United States; also that the commerce has increased, and that the improvement tends to keep the freight rates down.

Further details in reference to this work may be found in the Annual Reports of the Chief of Engineers for 1896, page 797, and 1900, page 185.

Report upon survey of 1852 was made in October, 1853, and references to further examinations and surveys may be found in the Annual Report of the Chief of Engineers for 1904, pages 145–146.

Sketches of Shrewsbury River are printed in the Annual Reports of the Chief of Engineers for 1879, 1881, 1882, 1887, 1890, 1891, 1892, 1893, and 1905, page 1054, and maps of the whole river are printed in House Document No. 123, Fifty-eighth Congress, second session.

July 1, 1908, balance unexpended	$14,932.71
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	20,000.00
Received from sale of maps during the year	6.00
	34,938.71
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	14,097.54
July 1, 1909, balance unexpended	20,841.17
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix G 6.)

7. *Manasquan River, New Jersey.*—This is a small stream in the eastern part of New Jersey which empties into the Atlantic Ocean about 26 miles south of Sandy Hook; in its natural condition the low-water depth for several miles above the mouth varied from 4 to 6 feet. The outlet, however, was obstructed by a shifting sand bar, on which the depth did not exceed 1½ feet. After severe storms this outlet was sometimes entirely closed, remaining so until sufficient fresh water had accumulated in the river above to force an outlet into the ocean.

A project for its improvement, adopted by the river and harbor act of March 3, 1879, based on examination and survey as printed in Annual Report of the Chief of Engineers for 1879, pages 463–466, contemplated obtaining a permanent outlet for the river nearly at right angles to the shore, with a depth of 6 feet at mean low water; also dredging a channel in the lower river to the same depth. The estimated cost was $52,120. Work was suspended in 1883, after three appropriations, amounting to $39,000, had been expended on the improvement in the construction of two training dikes 1,515 and 475 feet long, respectively.

The existing project, approved March 3, 1899, with subsequent modifications, which is a modification of the original project, contemplates obtaining an outlet 6 feet deep for the river, and also in deepening the channel just above the mouth to the same depth, at an additional cost of $18,300 over the amount expended and on hand, making the total estimated cost of the improvement $59,300, to which should be added $1,075 expended for maintenance. References to examinations and surveys are noted in the Annual Report of the Chief of Engineers for 1904, page 147.

The amount expended to June 30, 1909, was $41,054.11, of which $39,000 was used for carrying out the project and $2,054.11 for maintenance.

This improvement, under present project, is about half completed.

During the past fiscal year no work was done on this improvement. Expenditures were for traveling expenses.

No further appropriation is recommended until the question of the usefulness of expenditures under the project has been decided.

The maximum draft that could be carried June 30, 1908, was about 2 feet at mean low water. No soundings have been made this season. Mean range of tides, 2.4 feet.

The commerce of the inlet is small. The river is used principally by small fishing craft; also by pleasure boats during the summer season.

The improvement has not advanced to a condition which would affect the rates of freight. It is stated that there will be a reduction when the entrance is made navigable.

Detailed descriptions of this improvement and histories of the work and maps are printed in the Annual Reports of the Chief of Engineers for 1880, Part 1, pages 547–556; 1882, Part 1, page 701; 1898, page 1070, and 1905, page 1056.

July 1, 1908, balance unexpended	$4,961.92
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	16.03
June 30, 1909, carried to surplus fund of the Treasury	4,945.89
Amount (estimated) required for completion of existing project	14,375.00

(See Appendix G 7.)

8. *Removing sunken vessels or craft obstructing or endangering navigation— Wreck of deck scow N. D. Shultz in Passiac River at Pennsylvania Railroad wharf on the north side of the river near its mouth.*— This wreck was reported in August, 1908, as a dangerous obstruction to navigation when one side broke off and lighting at night and marking by day were discontinued. It was previously reported as sunk at the wharf of the Pennsylvania Railroad Company, but was not then considered such an obstruction as contemplated by section 19 of river and harbor act of March 3, 1899.

The sum of $800 was allotted by the department on November 21, 1908, for the removal of this wreck. It was removed by the wrecking plant of John F. Baxter, under public notice dated November 28, 1908, for the sum of $792.

The wreck was deposited in the yard of the contractor at Weehawken. Nothing of value was found upon it.

(See Appendix G 8.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1909.

Report dated April 23, 1909, on preliminary examination of *Newark Bay, New Jersey, with a view to securing a channel along the eastern shore,* required by the river and harbor act of March 3, 1909, was duly submitted by the district officer. It was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and was transmitted to Congress and printed in House Document No. 80, Sixty-first Congress, first session. The locality is not considered worthy of improvement by the General Government in the manner indicated.

IMPROVEMENT OF RIVERS AND HARBORS IN THE PHILADELPHIA, PENNSYLVANIA, DISTRICT.

This district was in the charge of Maj. Herbert Deakyne, Corps of Engineers. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. Delaware River, New Jersey and Pennsylvania.—Trenton, the head of natural and actual navigation of the Delaware River, is about 30 miles above the upper end of the port of Philadelphia. In its original condition this stretch of river was obstructed by several shoals. Between Bordentown and Trenton, a distance of about 5 miles, a narrow and circuitous channel existed which carried only from 3 to 6 feet at mean low water. At Kinkora bar, about 9 miles below Trenton, there was a shoal carrying 7½ feet, and at Fivemile bar, opposite the upper part of Philadelphia, a shoal crossed the Pennsylvania channel, carrying only 3 to 4 feet at mean low water. There was, however, a depth of 13 feet past Fivemile bar in the New Jersey channel south of Petty Island.

Below Philadelphia the river in its original condition presented obstructions at Mifflin bar which reduced the depth at mean low water to 17 feet, at Schooner ledge and Cherry Island flats to 18 feet, at Bulkhead shoal and Baker shoal to about 20 feet, and at Duck Creek flats to about 20 feet. The lower end of Duck Creek flats is 56 miles below Philadelphia.

In that part of the Delaware River between Trenton, N. J., and Bridesburg, Pa., efforts in the past have been directed toward relieving commerce from the obstructions which exist in the upper 9 miles of the river and toward deepening the channels across Perriwig and Kinkora bars.

Previous to 1885 the efforts to improve the river between Philadelphia and the bay were confined to dredging, except at Schooner ledge, where solid rock was removed. The work was done under appropriations for special localities, and also under general appropriations for the Delaware River below Bridesburg.

A Board of Engineers, convened by direction of the Secretary of War for the purpose of considering the subject of the permanent improvement of Delaware River and Bay, recommended, in a project dated January 23, 1885, and adopted in that year, the formation of a ship channel from a point opposite Philadelphia and about midway between the American Ship Building Company's yard and the Gas Trust wharf to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean low water. The formation of such a channel was to be secured, except at Schooner ledge, where rock would have to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging where necessary, as an aid to such contracting and regulating works. The estimated cost of obtaining a channel of the above dimensions was about $2,425,000, which covered the estimated cost of the permanent improvement of the Delaware River between the upper part of Philadelphia and deep water in the bay. The annual cost of maintenance was estimated at 10 per cent of the original cost for dredging and 1 per cent of the original cost for dikes. This estimate of cost did not include the improvement of Philadelphia Harbor, which was a separate project.

With appropriations aggregating $3,935,000 there was completed between 1888 and 1898 a project for improving the harbor between Philadelphia, Pa., and Camden, N. J., which provided a channel depth of 26 feet at mean low water from Christian street, Philadelphia (Kaighn Point, N. J.), up to the Pennsylvania Railroad bridge at Fishers Point, N. J. In 1906 an allotment of $10,000 was made for redredging shoal places within the limits of this improvement, from the emergency appropriation contained in the river and harbor act approved March 3, 1905. Final report on the completion of this project is printed in the Annual Report of the Chief of Engineers for 1899, page 1330, and an account of the work done under the emergency allotment in the Report for 1907, page 1100.

In the river and harbor act approved March 3, 1899, Congress adopted a new project for the improvement of the river, providing for the formation of a channel 600 feet wide and 30 feet deep from Christian street, Philadelphia, to deep water in Delaware Bay, at an estimated cost of $5,810,000. This project superseded the project of 1885. At the time of adoption of the new project the 26-foot channel, with widths varying from 200 to 600 feet, had been formed from the upper part of Philadelphia Harbor to the bay, except at the following-named localities: Tinicum Island shoal, depth from 23.6 feet to 26 feet over a distance of about 4,200 feet; above Schooner ledge, depth from 24 feet to 26 feet over a distance of about 4,800 feet; from below Marcus Hook to Bellevue, depth from 23 to 26 feet over a distance of about 13,500 feet. These distances are measured on the range lines. The distances measured between the 26-foot curves on the lines of deepest water were much shorter.

Part of the 26-foot channel above Marcus Hook, Pa., was dredged by the city of Philadelphia under the supervision of this office, with money appropriated by the city of Philadelphia.

At the same time there was between Trenton and Philadelphia a channel 6 feet deep at mean low water through Perriwig bar, a depth of 7 feet in the eastern channel at Bordentown, a channel 8½ feet deep through Kinkora bar, and a channel 26 feet deep over the whole width through Fivemile bar.

The total amount expended on the 26-foot project since its adoption, in 1885, was $1,532,688.81, of which about $200,000 is estimated to have been applied to maintenance. In addition to this expenditure the following sums were expended since the adoption of the 26-foot channel, in 1885, and previous to adoption of the existing project, on special localities on the river under appropriations made for the purpose:

Channel across Smiths Island bar, between Philadelphia, Pa., and Camden, N. J.	$30,000.00
Between the upper part of Philadelphia, Pa., and Trenton, N. J.	37,500.00
Rebuilding and enlarging dike at junction of Schuylkill and Delaware rivers	3,000.00
Removing rock ledge opposite Petty Island	69,463.26
Expenses of Board of Engineer officers on project for channel 30 feet deep and 600 feet wide	7,000.00
Total	146,963.26

The entire amount expended on the improvement of Delaware River from 1836 to June 30, 1909, under appropriations for general river improvement, special localities, Philadelphia Harbor, and allotments from appropriations for emergencies in river and harbor works, was $13,420,754.23, of which $184,505.80 was expended on the part of the river between Trenton and Philadelphia, and $188,109.51 for maintenance under the existing project.

Work under the existing project below Christian street was commenced under an appropriation of $300,000 contained in the river and harbor act of March 3, 1899, and has been prosecuted under this and subsequent acts. Under the provisions of this act $69,463.26 was applied to removal of rock ledge opposite Petty Island, $7,000 to the expenses of the Board of Engineer officers on project for a 30-foot channel, and the balance, $223,536.74, under the existing project.

The river and harbor act approved March 2, 1907, appropriated the sum of $895,000 for completing this improvement and authorized the letting of contracts to the extent of $500,000 additional for maintenance of the dredged channel, this amount to be available, however, for use in completion of the project. Of this appropriation the sum of $40,000 is to be applied to maintenance of the dredged waterway in Philadelphia Harbor above Christian street, Philadelphia. Of the sum of $500,000 authorized by the river and harbor act of March 2, 1907, $375,000 was appropriated in the sundry civil act approved May 27, 1908, and the balance, $125,000, was appropriated in the sundry civil act approved March 4, 1909.

The river and harbor act approved March 3, 1909, appropriated $390,000 for maintenance of the dredged channel from Philadelphia to Delaware Bay, including Philadelphia Harbor.

Up to the close of the fiscal year ending June 30, 1909, the sum of $6,383,671.61 was expended on the work of the existing project in surveys, in dredging at Duck Creek flats, Baker shoal, Salem Cove flats, Deep Water Point, Cherry Island flats, Schooner ledge rock area, Tinicum and Mifflin bar shoals, and in the construction of bulkheads for the reception of dredged material and to act as training walls to direct the currents.

At Baker shoal the work of bulkhead construction has resulted in the completion of 30,627 linear feet of structure. At Cherry Island flats the work of bulkhead construction has resulted in the completion of 4,535 linear feet of structure. The work of dredging under the 30-foot project has resulted in the formation of a channel 30 feet deep at mean low water and 600 feet wide, having the following approximate lengths through the various shoals:

	Feet.
Duck Creek flats	43,000
Baker shoal	20,500
Salem Cove flats	12,500
New Castle flats	28,000
Cherry Island flats	25,500
Edgemoor, Delaware, to the south line of Pennsylvania, including Marcus Hook bar	30,000

The work of rock removal at Schooner ledge is now about 99 per cent completed.

The greatest draft of water that could be carried at mean low water on June 30, 1909, over the shoalest part of the river below Philadelphia, was about 23.9 feet on center line of channel on Cherry

Island light-house range, near the mouth of Christiana River, Delaware. The material in the channel at this locality is very soft mud.

It is proposed to apply the available funds to completion of the project and maintenance of the dredged channel. This will include widening of the channel beyond 600 feet at the bends below Philadelphia, completion of rock removal at Schooner ledge, and surveys, engineering and office expenses under the general project, the work to be done by contract or by hired labor and government plant, as may be to the best interests of the United States.

In 1905 the State of Pennsylvania and the city of Philadelphia appropriated sums aggregating $750,000, to be expended in accordance with the general project on that part of the river between the south line of Pennsylvania and the city of Philadelphia. This money was to be expended by the city of Philadelphia, and the work to be done was to be under the supervision of the United States engineer officer in charge of the improvement.

Under date of July 27, 1906, the United States entered into an agreement with the city of Philadelphia whereby government plant should be placed on the work in sections 7 and 8 and operated under the direction of this office; all cost of the work to be paid by the city of Philadelphia. The city also entered into a contract with the American Dredging Company, under date of October 27, 1906, for the dredging of the entire channel to full width and depth in sections 6–A, 6–B, and 9, for a lump sum in each case.

Work under the above agreement with government plant in sections 7 and 8 has resulted in a channel through Tinicum Island flats 30 feet deep and 600 feet in width, and a channel through Mifflin bar shoal 30 feet deep and 600 feet wide.

The contract dredging has resulted in a channel 30 feet deep and 600 feet wide through section 6, subsections A and B, on Schooner ledge range, and through section 9, to Christian street, Philadelphia.

The original work on the channel 30 feet deep and 600 feet wide is now practically completed from Christian street, Philadelphia, to deep water in Delaware Bay, except on Schooner ledge rock area, where a few scattering points of rock remain to be drilled and blasted off. It is estimated that only about 330 cubic yards of ledge rock remains to be removed, consisting of widely scattered points projecting from 0.1 foot to 1 foot above the plane of 30 feet mean low water. This work is being pushed as rapidly as is practicable, but from its nature is necessarily tedious.

For 1890 the total foreign freight movement of the Delaware River was estimated at 2,923,994 tons and the total domestic freight movement at 8,433,276 tons; total, 11,356,270 tons. For 1908 the total foreign freight movement was estimated at 5,083,487 tons and the total domestic freight movement at 18,940,408 tons; total, 24,023,895 tons.

The deepening of the channel below Philadelphia increases the number of deep-draft vessels trading with foreign ports. The establishment of existing lines has resulted in lower import and export rates. The maintenance of a deep channel from Philadelphia to the sea also affects the rates at other ports by keeping up the competition between them and this port. No exact figures can be given which will show the amount that freight rates have been lowered by the improvement.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenence of improvement by dredging and repair of regulating works.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1907 and 1908, is compiled from the reports of the Board of Trade of the city of Philadelphia:

Articles.	1907.	1908.
IMPORTS.	*Tons.*	*Tons.*
Drugs and chemicals	144,717	132,723
Hemp, jute, flax, and their fabrics	36,257	26,095
Iron, manufactured	31,396	13,545
Iron ore	600,598	585,126
Sugar	200,370	199,978
Miscellaneous	787,182	593,548
Total	1,800,520	1,551,015
EXPORTS.		
Coal	930,599	799,862
Grain and flour	581,013	683,716
Petroleum and products	1,124,673	1,188,277
Miscellaneous	1,420,431	860,617
Total	4,056,716	3,532,472

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1907 and 1908, has been compiled from returns made by shippers, consignees, and carriers:

Articles.	1907.		1908.	
	Tons.	Value.	Tons.	Value.
ARRIVALS.				
Chemicals	312,560	$4,825,498	221,795	$3,938,315
Coal	715,493	2,553,793	684,684	2,593,165
Lumber	961,347	10,588,854	729,562	7,844,366
Sand	2,345,398	1,283,131	1,910,510	1,045,968
Miscellaneous	4,827,537	781,240,860	4,496,646	577,842,375
Total	9,162,335	800,492,136	8,043,197	593,264,209
DEPARTURES.				
Chemicals	119,385	2,344,170	95,508	2,175,450
Coal	7,877,432	30,764,762	7,150,315	27,854,154
Fertilizers	114,736	2,303,720	129,013	2,818,753
Iron, manufactured	20,096	485,198	13,320	400,000
Miscellaneous	4,132,309	573,344,187	3,509,055	469,721,940
Total	12,263,958	609,242,037	10,897,211	502,970,297

July 1, 1908, balance unexpended		[a]$803,279.89
June 30, 1909, credited to appropriation during fiscal year: Sales of blueprints, $22.47; account services U. S. dredge *Delaware* in New York Harbor, $11,163.07; account of judgment in case of libel filed in U. S. district court for New Jersey against coal barge *Alaska* as damages sustained by the United States by reason of sinking by the barge of a scow belonging to the Engineer Department, $1,400; account proceeds of sales of condemned property, $604.43		13,189.97
Amount appropriated by river and harbor act approved March 3, 1909		390,000.00
Amount appropriated by sundry civil act approved March 4, 1909		125,000.00
		[a]1,331,469.86
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$652,969.05	
For maintenance of improvement	179,399.34	
		[b]832,368.39
July 1, 1909, balance unexpended		[a]499,101.47
July 1, 1909, outstanding liabilities		[a]104,294.64
July 1, 1909, balance available		394,806.83
July 1, 1909, amount covered by uncompleted contracts		141,475.80
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		200,000.00

(See Appendix H 1.)

2. *Perriwig bar, Delaware River.*—The project for this improvement was adopted March 2, 1907, and provides for dredging a channel 7 feet deep at mean low water, with a bottom width of 200 feet, in three straight stretches through Perriwig bar, between Trenton and Bordentown, at estimated cost of $50,000. This sum was appropriated in the river and harbor act of March 2, 1907, for completing the improvement.

The plan of proposed improvement is printed in House Document No. 852, Fifty-ninth Congress, first session.

This work was completed during the fiscal year ending June 30, 1908, at a cost of $49,527.99, and has resulted in the formation of a channel through the bar 7 feet deep at mean low water and about 6,000 feet long, with a bottom width of 200 feet. The total expenditures to June 30, 1909, amounted to $50,000.

This improvement has enabled the steamship companies to continue their service and maintain the present low freight rates between Philadelphia and Trenton. Otherwise these steamers would necessarily have been withdrawn, and the only means of communication between the two cities would have been by railroad, on which the freight rates are much higher than by water.

During the past fiscal year a survey of the dredged channel was made, which showed that only a small amount of shoaling had occurred. Expenditures during the past year were in payment of expenses of this survey and of outstanding liabilities incurred during the year 1908.

---

[a] This amount includes a balance of $15.67 remaining from an allotment of $10,000 for Philadelphia Harbor from the emergency appropriation made in the river and harbor act of March 3, 1905.

[b] This amount has been reduced by $903.85, which latter will be restored to this appropriation on account of payments made for the Isthmian Canal Commission.

July 1, 1908, balance unexpended	$640.34
Amount allotted from appropriation by river and harbor act approved March 3, 1909	1,500.00
	2,140.34
June 30, 1909, amount expended during fiscal year, for works of improvement	640.34
July 1,1909, balance unexpended	1,500.00

(See Appendix H 2.)

3. Bordentown bar, Delaware River.—Under date of April 20, 1908, an allotment of $500 was made by the Secretary of War from the emergency appropriation of $300,000, carried by the river and harbor act approved March 2, 1907, for a survey to determine the work necessary to restore the channel for navigation. An additional allotment of $9,500 was made from the same appropriation under date of June 8, 1908, for dredging under the project.

The project provides for a channel 7 feet deep at mean low water, with a bottom width of 200 feet, or as near that width as the funds will permit, in two straight reaches through Bordentown bar.

The work was completed during the past fiscal year and has resulted in a channel 7 feet deep, with a bottom width of 160 feet, and a length of 3,600 feet. The total cost of this work, including the sum of $270.67 expended on the survey, was $10,000.

This improvement has given relief to steamers running between Philadelphia and Trenton, and has enabled them to pass over the bar at all stages of the tide.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenance of improvement by dredging.

July 1, 1908, balance unexpended	$9,743.91
June 30, 1909, amount expended during fiscal year, in restoration of channel	9,743.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix H 3.)

4. Sewer shoal, near Trenton, N. J.—Under date of May 12, 1909, an allotment of $15,000 was made by the Acting Secretary of War from the emergency appropriation of $500,000 provided by section 2 of the river and harbor act approved March 3, 1909, to be applied to dredging a channel through the shoal known as "Sewer shoal," near Trenton, N. J., 7 feet deep at mean low water, with a bottom width of 200 feet, or as near that width as the funds will permit.

Dredging is in progress under an emergency contract dated June 1, 1909, with the American Dredging Company. At the end of the fiscal year about 40 per cent of the work was completed.

Amount allotted from appropriation for emergencies in river and harbor works, act of March 3, 1909, for maintenance of improvement	$15,000.00
June 30, 1909, amount expended during fiscal year	5.80
July 1, 1909, balance unexpended	14,994.20
July 1, 1909, outstanding liabilities	324.17
July 1, 1909, balance available	14,670.03
July 1, 1909, amount covered by uncompleted contracts	14,000.00

(See Appendix H 4.)

5. *Ice harbor at Marcushook, Pa.*—In 1785 the Commonwealth of Pennsylvania built two wharves upon crib piers at Marcushook for the convenience of commerce. In 1829 an appropriation was made by Congress for repairing the piers and improving the harbor.

In 1866 a project was adopted for a harbor in Delaware River to protect vessels against moving ice. The old work at Marcushook was utilized as far as possible. The amount expended from 1866 to June 30, 1909, was $219,000. Since 1899 all expenditures have been for repairs and maintenance. The last amount appropriated for the work was $5,000, by act of September 19, 1890.

The harbor covers an area of 12 acres, of which about one-half has a depth of 12 to 18 feet and the other half 18 to 25 feet at mean low water. The protection consists of the old landing piers and seven detached piers, having foundations of wooden cribs filled with stone, the superstructures being faced with cut stone. The detached piers are in need of minor repairs.

During the past fiscal year repairs were made to the mooring posts and other parts of the piers.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenance of improvement by the repair of superstructure of ice piers.

Rules for the use of the landing piers were approved by the Acting Secretary of War under date of April 29, 1904.

July 1, 1908, balance unexpended	$37.54
June 30, 1909, amount expended during fiscal year	37.54
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	600.00

(See Appendix H 5.)

6. *Iron pier in Delaware Bay, near Lewes, Del.*—The original project for this work proposed the construction of a landing pier about 1,700 feet in length, extending from the shore south of the breakwater into Delaware Bay, to a depth of 22 feet at mean low water, the pier to consist of a substructure of wrought-iron screw piles, surmounted by a timber superstructure. The work was commenced in 1871, and completed, except as to superstructure, in 1880.

The work done to June 30, 1890, resulted in the construction of 1,155 linear feet of pier 21 feet in width and 546 linear feet 42 feet in width, or a total length of 1,701 feet. The depth of water at the outer end of the pierhead was about 21 feet at mean low water. Since its construction the pier has been repaired and cared for by the United States.

The total expenditures to June 30, 1909, were $385,339.40. Of this amount $27,000 was applied to the maintenance of the improvement.

The right to use the pier for railway purposes, granted in the act of July 15, 1870, has never been and doubtless never will be exercised, as the pier has not sufficient strength to support the weight of modern freight engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure.

During the past fiscal year no work was in progress.

The pier is of great use for the purposes of the government engineer, light-house, and quarantine services. It is of very great value to vessels frequenting the breakwater harbor in winter, when the harbor is packed with floating ice, rendering the anchorage dangerous. At such times vessels eagerly seek its shelter and protection. The unexpended balance of $820.60 was carried to the surplus fund on June 30, 1909.

The mean range of tide at the pier is 4.5 feet.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenance of improvement by repair of pier.

July 1, 1908, balance unexpended	$820.60
June 30, 1909, amount carried to surplus fund	820.60
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	1,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix H 6.)

7. *Delaware breakwater, Delaware.*—The final report of the local officer upon this work was submitted June 19, 1899, and is printed in the Annual Report of the Chief of Engineers for 1899, page 1346.

The depths in the protected anchorage vary from 11½ to 18 feet at mean low water, and the harbor is available for vessels drawing up to about 16 feet.

The amount expended on this work up to June 30, 1909, was $2,806,479.06. No portion of this amount has been applied to maintenance.

During the fiscal year ending June 30, 1903, a survey of the breakwater harbor was completed as a part of a survey of the national harbor of refuge.

The mean range of tide is 4.5 feet.

The unexpended balance of $875.64 was carried to the surplus fund on June 30, 1909.

July 1, 1908, balance unexpended	$875.64
June 30, 1909, amount carried to surplus fund	875.64

(See Appendix H 7.)

8. *Harbor of refuge, Delaware Bay, Delaware.*—The project for the construction of this harbor, which was adopted and provided for under

the continuous-contract system in the river and harbor act of June 3, 1896, includes the construction of a breakwater on the line of least depth along the eastern branch of the shoal known as the "Shears," and the construction of a row of ice piers across the upper end of the harbor to protect it from ice descending the bay, at a total cost not to exceed $4,665,000.

No expenditures were made on this improvement previous to June 30, 1896.

Up to the close of the fiscal year ending June 30, 1909, $2,238,205.34 had been expended in the construction of the breakwater and ice piers.

No part of this amount was applied to the maintenance of the work.

During the fiscal year ending June 30, 1904, the sum of $338.43 was expended on a survey of the harbor.

The breakwater was completed on December 11, 1901. The superstructure of the breakwater has a length of 7,950 feet and the substructure a length of 8,040 feet, measured on the low-water line.

A project for the construction of 10 ice piers was submitted on April 5 and approved April 23, 1900. This work was commenced during the fiscal year ending June 30, 1901, and completed November 22, 1902. Seventy-one thousand three hundred tons of stone was deposited in the work.

A project for the construction of additional ice piers was submitted under date of June 7 and approved June 30, 1902. Work under this project was begun August 4, 1902, and completed June 19, 1903. Thirty-seven thousand six hundred and seventy-three tons of stone was deposited, completing 5 ice piers.

A report was submitted under date of November 19, 1902, containing project and estimates for further protection of the harbor. A further report on this subject, containing a detailed project and estimate of cost of the proposed extension of the breakwater at this harbor, was submitted under date of November 14, 1903. Both reports and the recommendations of the Board of Engineers for Rivers and Harbors are published in House Document No. 548, Fifty-eighth Congress, second session, and also contained in the Annual Report of the Chief of Engineers for 1904, pages 1215–1225.

The great value of this harbor to commerce is due to its location. It is about equidistant from New York, Philadelphia, and the capes of Chesapeake Bay (the ocean entrance for the ports of Baltimore, Norfolk, and Newport News), and is therefore an especially convenient port of call for the entire commerce of the North Atlantic coast. It is now largely used by vessels awaiting orders to ports for discharge or loading. During the year ending December 31, 1908, 1,035 vessels (not including small craft) called at this harbor.

By the construction of the breakwater the usefulness of this anchorage has been greatly increased, not only as a port of call but also as a harbor of refuge. Vessels bound from northern to southern or from southern to northern ports are able to go to sea in doubtful weather with the assurance of finding ample protection at the Delaware capes if overtaken by storm.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1216. A map is printed in House Executive Document No. 112, Fifty-second Congress, first session.

The mean range of tide is 4.5 feet.

The unexpended balance of $1,128.66 was carried to the surplus fund on June 30, 1909.

It is proposed to apply the amount estimated for expenditure during the fiscal year 1911 to maintenance of improvement by the repair of detached piers.

July 1, 1908, balance unexpended	$1,128.66
June 30, 1909, amount carried to surplus fund	1,128.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	8,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix H 8.)

9. *Removing sunken vessels or craft obstructing or endangering navigation.*—(*a*) *Wreck of schooner Eden in Delaware River, close to Tinicum Island range.*—This wreck being considered a dangerous obstruction to navigation, its removal was authorized under date of February 25, 1908. A contract for the removal of this wreck was entered into, but the contractor abandoned the work before its completion.

The wreck was removed by plant belonging to the United States and hired labor, the work being completed on September 14,1908. The total cost of its removal was $413.68.

(*b*) *Wreck of a houseboat in Delaware River off the wharf at Fort Mott, N. J.*—This wreck being considered a dangerous obstruction to navigation, its removal was authorized under date of June 2, 1908. The removal of this wreck was completed on July 10, 1908, plant belonging to the United States and hired labor being employed in the execution of the work. The total cost of its removal was $301.65.

(*c*) *Wreck of schooner-rigged flat boat John A. Lingo in Delaware River, near Finns Point, N. J.*—This wreck being considered a dangerous obstruction to navigation, its removal was authorized on April 12, 1909. The work of removal was completed on April 19, 1909, by the use of plant belonging to the United States and by hired labor. The total cost of its removal was $200.

The total amount expended during the past fiscal year upon removal of wrecks was $915.33.

(See Appendix H 9.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT, APPROVED MARCH 2, 1907.

Reports dated April 20, 1907, and March 20, 1908, respectively, on preliminary examination and survey of *Neversink and Delaware rivers, New York,* with a view to the removal of bars and other obstructions at and near the mouth of the Neversink River, and of the Delaware River at and near the mouth of the Neversink River, required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors pursuant to law and were transmitted to Congress and printed in House Document No. 1164, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $61,392.50 is presented, of which amount an item of $6,612.50 for removal of a rock ledge, known as "Sims Clip," is regarded as chiefly benefiting raft navigation and should be borne by the United States, provided the balance of the work, estimated to cost $54,780, is provided for by State and local interests.

IMPROVEMENT OF RIVERS AND HARBORS IN THE WILMINGTON, DELAWARE, DISTRICT.

This district was in the charge of Maj. C. A. F. Flagler, Corps of Engineers, to July 31, 1908; in the temporary charge of Maj. Herbert Deakyne from July 31 to Sept. 15, 1908, and in charge of Capt. L. H. Rand, Corps of Engineers, since the latter date. Division Engineer Col. D. W. Lockwood, Corps of Engineers.

1. *Cooper Creek, New Jersey.*—This creek enters the Delaware River in the city of Camden, just above Cooper Point. It was navigable at mean high water for a distance of 9 miles from its mouth for vessels drawing 5 feet, and for the first 5 miles for vessels of 11½ feet draft. The mean range of the tide at the mouth is about 6 feet. For a distance of 1½ miles from the mouth the width of the stream averaged about 80 feet at low water and about 120 feet between the banks, and the channel in its original condition had a depth at mean high water of from 12 to 15 feet, except at one place where the depth was 9½ feet.

The project for this improvement was adopted in the river and harbor act of June 3, 1896, and is printed in the Annual Report of the Chief of Engineers for 1895, page 1102. It provides for the formation, by dredging, of a channel 70 feet wide at bottom and 18 feet deep at mean high water from the mouth of the creek to Browning's Chemical Works and a channel of the same dimensions through the bar just outside the mouth—in all, a distance of about 9,000 feet. The estimated cost, including contingencies, is $35,000.

The river and harbor act of June 3, 1896, appropriated $37,000 for completing this improvement, of which $2,500, or as much thereof as might be necessary, was to be expended in rebuilding the dike on the government reservation in the Delaware River at Woodbury Creek.

The sum of $2,500 was expended in rebuilding the dike at Woodbury Creek referred to, and the channel in Cooper Creek was dredged. This dredging resulted in the formation of a channel extending from the mouth to the Camden Iron Works, 7,500 feet long, 50 to 70 feet wide, except at the bridges, where the widths are 30 feet, and 18 feet deep at mean high water (12 feet at mean low water). At State street the depth made was only 14 to 15 feet on account of a city water main crossing the stream at that depth. Further operations were suspended to await the lowering of this pipe by the city.

In 1906, to meet the wants of the traffic in the creek, the channel was dredged between the State Street Bridge and the 12-foot contour in Delaware River to a depth of 12 feet at mean low water and a width of 70 feet.

The water pipe at State street was lowered in September, 1907, but no work has been done on the improvement since for want of sufficient funds. The expenditure during the year was for examination and supervision expenses.

About 65 per cent of the projected work is completed.

Under date of April 21, 1909, the Chief of Engineers allotted $5,000 from the appropriation made by the river and harbor act of March 3, 1909, for preservation and maintenance of river and harbor works, and approved project for expenditure of available funds, and bids for the dredging to be done thereunder will soon be opened.

The maximum drafts that could be carried on June 30, 1909, at mean low water were 12 feet from the Delaware River to the Federal Street Bridge, thence 9½ feet to Camden Iron Works, and thence 6½ feet to Browning's Chemical Works. The stream is navigable nearly to Medford Branch of Pennsylvania Railroad, a distance of 9 miles.

The expenditure during the year was for examination and supervision expenses.

The amount expended to June 30, 1909, is $31,058.90, exclusive of the $2,500 expended in rebuilding dike at Woodbury Creek. Of this amount $5,382.80 was for maintenance.

The commerce for the calendar year 1908, reported by the Camden Board of Trade, was 221,205 tons, valued at $1,807,633.

The effect of the improvement made in this stream on freight rates has been to reduce them by permitting larger vessels to be secured for long voyages than was formerly possible. The railroad rates to points in the United States east of Cape Cod are 25 per cent higher than by water.

It is proposed to expend the funds recommended below to complete the project dimensions of the channel above the State Street Bridge and to maintain the improvement by dredging. This will extend the benefits of the improvement.

July 1, 1908, balance unexpended	$3,499.32
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	5,000.00
Received from sales	100.00
	8,599.32
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	58.22
July 1, 1909, balance unexpended	8,541.10
Amount (estimated) required for completion of existing project	5,131.18
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	11,000.00

(See Appendix I 1.)

2. Mantua Creek, New Jersey.—Mantua Creek is a stream flowing into the Delaware River at a point about 10 miles below the terminal and ferry of the Pennsylvania Railroad at Camden, N. J.

In its original condition it was navigable at high water for a distance of one-half mile above its mouth to the phosphate works of the I. P. Thomas & Sons Company for vessels of 13 feet draft; thence 3¼ miles farther, to Paulsboro, for vessels drawing 9 feet; thence 3¼ miles to Parkers Landing for tugs and barges drawing 6 feet, this being the head of steam navigation; thence 4.1 miles to Mantua, 11¼ miles above the mouth, small boats and barges of 3 to 4 feet draft passed up on the tide. The navigable portion is generally bordered by low ground, protected from overflow by earthen banks. The general course of the stream is tortuous, and its navigation was much obstructed by bars, sharp bends, and the upper portion by stumps and overhanging trees. The stream, on account of its flat watershed, is subject to only moderate freshets, which seldom exceed 2 to 3 feet above tide water. The range of tide is 6 feet at the mouth, 4.5 feet at Paulsboro, 3.4 feet at Berkley, and 2 feet at Mantua, which is the head of navigation. The low-water width near the mouth averaged 160 feet, decreasing to about 100 feet at Paulsboro. Above Paulsboro the width decreased to 88 feet at Parkers Landing, and near Mantua to 50 feet.

The approved project for the improvement, which was adopted by Congress in river and harbor act of March 3, 1899, contemplates the dredging of a channel 100 feet wide on the bottom and 12 feet deep from the 12-foot contour in the Delaware River, through the marsh to the phosphate works, a distance of 2,200 feet; thence 80 feet wide on the bottom and 8 feet deep to Paulsboro, 6,300 feet, making a channel nearly direct by cutting off three bends; thence to Parkers Landing, near Berkley, 3 miles, with one cut-off 60 feet wide and 7 feet deep; and the dredging of a cut-off 350 feet long, 50 feet wide, and 3 feet deep, 9,000 feet above Berkley; also the removal of overhanging trees above Berkley and the construction of jetties on both sides at the mouth of the creek. The estimated cost of this improvement is $145,030. Such lands and rights as were considered necessary for the cut-offs were purchased in September, 1900, at a cost of $8,000.

Between 1901 and 1905 the channel between the phosphate works and Paulsboro was dredged to the project dimensions and the three cut-offs made as planned, and a channel 12 feet deep at mean low water dredged direct from the 12-foot contour in the Delaware River to the phosphate works, cutting off the old mouth, the width made being 110 feet across the flats and 100 feet at the upper and lower ends of the dredging.

For the protection of the channel at the mouth a jetty 754 feet in length was constructed in 1907, on the east side of the channel, and a jetty 579.5 feet on the west side, and a dike, 524 feet long, to close the old mouth of the river.

During the fiscal year 1909 the channel was dredged to a depth of 13 feet at mean low water and a width of 100 feet from the 12-foot curve in the Delaware River to the upper end of the I. P. Thomas & Sons' fertilizer works, thence 9 feet deep and 80 feet wide to the highway bridge at Paulsboro, and thence a distance of 12,000 feet 8 feet deep and 60 feet wide, these depths including 1 foot for overdepth allowed under the contract. The portion of this work below the Paulsboro highway bridge was maintenance work.

About 55 per cent of the projected work has been done.

The amount expended on the improvement to June 30, 1909, is $96,707.35, of which $93,707.35 is on the present project, and of this latter $7,203.18 was for maintenance.

The maximum drafts that could be carried on June 30, 1909, at mean low water over the part of the creek under improvement are 12 feet to the phosphate works, thence 8 feet to Paulsboro, and thence, for 12,000 feet, 7 feet. The stream is navigable for small craft for about one-half mile above Mantua.

It has been impracticable to obtain commercial statistics for the entire river, but the receipts by water at Mantua during the calendar year 1908 were 35,250 tons, valued at $214,225. This is but a small fraction of the entire traffic.

The river and harbor act of March 3, 1909, provided for a preliminary examination and survey of Mantua Creek, "with a view to continuing improvement to the head of navigation," and the survey is now in progress.

It is proposed to expend the funds recommended below on the construction of the project channel above Paulsboro and on the maintenance of the improvement below Paulsboro by dredging and jetty repairs. This will extend the availability of the stream for navigation.

July 1, 1908, balance unexpended		$13,167.16
Received from sales		100.00
		13,267.16
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$5,221.33	
For maintenance of improvement	7,203.18	
		12,424.51
July 1, 1909, balance unexpended		[a] 842.65
Amount (estimated) required for completion of existing project		57,783.18
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		31,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix I 2.)

3. Raccoon Creek, New Jersey.—This creek rises in Gloucester County, flows in a northwesterly direction, and empties into the Delaware River at a point nearly opposite Marcushook, Pa. A preliminary examination and survey of Raccoon Creek was made in 1899, and a report, with estimated cost of improvement, is printed in Annual Report of the Chief of Engineers for 1900, pages 1590–1598.

It was navigable at high water for a distance of 1¾ miles above its mouth to Bridgeport for vessels of 9 feet draft, thence 3¼ miles farther to Springer's wharf for vessels drawing 7 feet, and thence 4¾ miles to Swedesboro, the head of steam navigation for boats and barges having a draft of 4 feet. Above Swedesboro the stream was narrow, shoal, and very crooked. The navigable portion, when it left fast land, wound through meadows lying 2 or 3 feet above low water, which, except for the 2 miles immediately below Swedesboro, were generally protected from overflow by revetted earthen banks. Navigation was much obstructed by bars and a few sharp bends.

The range of tide varies from 6 feet at the confluence with the Delaware River to 4.9 feet at Swedesboro, where it is considerably influenced by winds and freshets.

The approved project, adopted by river and harbor act of June 13, 1902, proposes the formation of a dredged channel 7 feet deep and 75 feet in width at mean low water from the mouth for a distance of 1¾ miles to Bridgeport, thence a channel of the same depth and 60 feet wide to Springer's wharf, and thence a channel 5 feet deep at mean low water and 40 feet in width to the head of navigation at Swedesboro, 9¾ miles from its mouth, together with the widening of the channel around sharp bends, at an estimated cost of $102,135.

---

[a] In addition to this balance the sum of $7,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

Between 1903 and 1906 a continuous channel was dredged to the project dimensions from the mouth to the highway bridge at Swedesboro, except widening at bends and the construction of the cut-off at Molonox shoal.

The river and harbor act of March 2, 1907, appropriated $15,000 for continuing the improvement and for maintenance, and authorized a sufficient amount thereof to be applied to the making of a cut-off at Molonox shoal, with proviso that no expenditure should be made thereon until the land needed therefor should have been deeded to the United States free of expense. This title has been acquired and contract entered into for making the cut-off. Work under this contract was begun on May 13, 1909, and to the end of the fiscal year a length of 3,370 feet of channel had been completed. The maintenance expenses were for supervision and examination.

The amount expended on the improvement to June 30, 1909, is $26,271.30, of which $3,246.76 was for maintenance. Of the former amount $25,514.07 was on the present project.

The maximum drafts that could be carried on June 30, 1909, at mean low water were 7 feet from the Delaware River to Bridgeport, 6 feet to Springer's, and 4 feet thence to Swedesboro.

The improvement of the stream has so far had no marked effect upon freight rates. Perishable freight is now expeditiously carried and bulky freight by water costs only about half that by rail. The execution of the work has altered the stream by increasing the tidal range in the upper waters about 1 foot and, therefore, to effect the provisions of the project, it is necessary to do additional dredging to secure the low water depth contemplated. About one-half of the projected work has been done.

The commerce of the creek during the calendar year 1908, as reported, was 92,268 tons, valued at $879,150.

It is proposed to expend the funds recommended below in obtaining the project depth on the new mean low water level, in widening the bends, and in maintenance; all in extension of benefits to navigation.

July 1, 1908, balance unexpended		$23,941.69
Received from sales		100.00
		24,041.69
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,021.66	
For maintenance of improvement	191.33	
		2,212.99
July 1, 1909, balance unexpended		21,828.70
July 1, 1909, outstanding liabilities		1,980.00
July 1, 1909, balance available		19,848.70
July 1, 1909, amount covered by uncompleted contracts		14,700.00
Amount (estimated) required for completion of existing project		57,326.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix I 3.)

4. Salem River, New Jersey.—In 1872 the upper part of this river was separated from the lower part by a dam and was connected with the Delaware River by a canal forming two independent streams with mouths about 10 miles apart.

Prior to the adoption of the present project $17,209.34 had been expended on improvement of this stream, of which $10,000 was applied to work in Salem Cove, at the natural mouth below Salem, with which a channel 8 feet deep and 100 feet wide at low water was obtained, and $7,209.34 to improvement of the upper river in the formation of a channel 6 feet deep and 50 feet wide at mean low water up to Hoxies Landing.

Report of survey on which the present project is based is printed in the Annual Report of the Chief of Engineers for 1897, page 1245, and report thereon by the Board of Engineers for Rivers and Harbors is printed in River and Harbor Committee Document No. 12, Fifty-ninth Congress, second session.

The existing project was adopted by the river and harbor act of March 2, 1907, which appropriated $29,000 for completion of the improvement. It provides for dredging the lower river below Salem 100 feet wide and 9 feet deep at mean low water, amplifying at the bends so as to permit the passage of vessels 200 feet long from Delaware River up to the highway bridge over Little Salem Creek, including the removal of the stony bars in front of the city wharves and at the bend above the brickyard. The estimated cost of this work, as given by the Board of Engineers for Rivers and Harbors in report of January 16, 1907, is $29,000, subsequently increased to $38,600.

After an examination of the channel proposals were invited in July, 1907, for the required dredging, but as only one bid was received, at 27.5 cents per cubic yard, which was considered excessive, it was rejected. Proposals were again opened in May, 1908, under more favorable conditions, the lowest bid received this time being 19.9 cents per cubic yard.

In the examination above referred to it was found that the amount of material to be excavated to obtain the project channel dimensions, with an allowance of 1 foot for overdepth dredging, would be considerably in excess of that given in the report of survey of 1897, and, upon recommendation of the Chief of Engineers, the Secretary of War, in accordance with section 2 of the river and harbor act of March 2, 1907, authorized the expenditure of the available funds to the excavation of a channel of such dimensions as could be secured thereby.

Accordingly a contract for dredging was entered into and completed April 30, 1909. The channel was dredged to a depth of 10 feet, including one foot for overdepth made under the contract, and a width of 100 feet from the 9-foot curve in the Delaware River to the 9-foot depth in Salem River, a distance of 7,350 feet; and from the lower part of Little Salem River to the Covered Bridge, a stationary structure, a distance of 2,920 feet, the channel was dredged to a depth of 9 feet at mean low water and a width of 75 feet, resulting in a channel 9 feet deep at mean low water from the Delaware River to the Covered Bridge, the head of navigation at Salem, a distance of about 4½ miles, the width being 100 feet in the Delaware River to inside the mouth of Salem River, widening to 200 feet at the beacon, and thence 75 feet to Salem. The maintenance expense was for examination and supervision.

About 80 per cent of the projected work has been done.

The maximum draft that could be carried on June 30, 1909, at mean low water over the part of the river under improvement between Salem and the Delaware River was 9 feet, the rise and fall of tide being 6 feet.

The amount expended on the improvement to June 30, 1909, is $45,273.89, of which $28,064.55 is on the present project, of which $357.22 was for maintenance.

The commerce for the calendar year 1908 was 121,658 tons, valued at $3,063,051. The effect of the improvement on freight rates has not been reported, but it has facilitated and expedited shipments of fruits and other perishable merchandise.

In view of the fact that the approved project can not be completed with the funds appropriated on the original estimate for completion, recommendation is made below for an additional appropriation of $9,957.22 to complete the project, and for the necessary funds to maintain the channel, all of which will extend the benefits resulting.

July 1, 1908, balance unexpended		$28, 063. 11
Received from sales		100. 00
		28, 163. 11
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$26, 770. 44	
For maintenance of improvement	357. 22	
		27, 127. 66
July 1, 1909, balance unexpended		[a]1, 035. 45
July 1, 1909, outstanding liabilities		13. 20
July 1, 1909, balance available		1, 022. 25
Amount (estimated) required for completion of existing project		9, 957. 22
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		14, 600. 00

(See Appendix I 4.)

5. *Alloway Creek, New Jersey.*—This is a tidal tributary of the Delaware River, flowing westerly in the southwestern part of New Jersey, its mouth being about 50 miles below Camden, N. J. In its original condition the creek was obstructed between its mouth and Quinton, a distance of about 10 miles, by shoal areas in the upper half of the stream, which reduced the low-water depths to from 1.3 to 4 feet. The mean range of tide is 6 feet at the mouth and 4 feet at Quinton, the head of navigation.

The original project of 1889 proposed the formation by dredging of a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above upper Hancock Bridge; thence a channel of the same depth and 75 feet wide to a locality known as the "Square," where the work was to be supplemented by a dike. At a locality known as the "Canal," in addition to a channel of the last-named dimensions, the width of the stream was to be increased to about 150 feet between its low-water lines. The project was modified on December 10, 1896, so as to provide for a dike formed by a single row of piles above upper Hancock Bridge. This modification did not increase the originally estimated cost of the work, which is $25,000.

---

[a] In addition to this balance the sum of $5,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

Channels from 40 to 75 feet wide and 6 feet deep at mean low water have been dredged at various localities, and dikes 300 and 404 feet in length, respectively, have been constructed at the "Square" and above upper Hancock Bridge. The channel has been dredged not less than 75 feet wide and 6 feet deep from the mouth to a point one-half mile below Hancock Bridge, and thence 60 feet wide and 6 feet deep to the upper end of a shoal just above Hancock Bridge, a distance of 4.92 miles. This work extended to January, 1908.

The river and harbor act of March 2, 1907, appropriated $5,000 for continuing improvement and maintenance, and authorized a sufficient amount thereof to be applied to the construction of a cut-off at Fosters Bottle, with the proviso that no expenditure should be made thereon until all land needed for such cut-off should be deeded to the United States free of expense. During the past fiscal year this title was obtained, and under a contract the cut-off at Fosters Bottle was made, and resulted in a straight channel through it of a minimum depth of 7 feet at mean low water and a bottom width of a least 75 feet, 1 foot overdepth and side slopes having been allowed in accordance with the contract. This completed the contract.

The amount expended on the improvement to June 30, 1909, is $28,875.84, of which $7,478.11 was for maintenance.

The maximum draft that could be carried on June 30, 1909, to Quinton, was 4½ feet.

The commerce of the creek consists of miscellaneous articles, such as coal, sand, lumber, agricultural products, etc. The tonnage for the calendar year 1908 was 18,490, valued at $658,125.

The freight rates are reported to have been lowered by reason of the improvement of the creek, but to what extent is not stated. Larger boats are enabled to enter and depart, and shipments have been facilitated very much by avoiding delays in waiting for tides.

It is proposed to expend the funds recommended below in maintenance of the improvement by dredging, which will extend the benefits of the improvement.

July 1, 1908, balance unexpended	$5,032.87
Received from sales	100.00
	5,132.87
June 30, 1909, amount expended during fiscal year for works of improvement	4,908.71
July 1, 1909, balance unexpended	[a] 224.16
Amount (estimated) required for completion of existing project	200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	7,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I 5.)

---

[a] In addition to this balance the sum of $5,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

6. *Cohansey River, New Jersey.*—In its original condition this river or creek was navigable to Bridgeton, 19 miles above the mouth, through a tortuous channel of ample depth. The obstructions to navigation were found at Bridgeton, where the city gas and water mains were laid at a depth of only 4 feet below low water, and at the mouth, where the river discharged into Delaware Bay across a soft mud bar without any well-defined channel. At Bridgeton there is a fixed bridge known as the Nail Works Bridge, and just above the bridge is a milldam which limits the tidal basin of the stream.

Prior to adoption of the present project $36,000 had been expended in dredging a channel 7 feet deep at mean low water 70 to 90 feet wide to the Broad Street Bridge, 40 feet wide above to the Commerce Street Bridge, thence 4 feet deep to the Nail Works Bridge.

The present project is printed in House Document No. 645, Fifty-ninth Congress, first session, and was adopted in the river and harbor act of March 2, 1907. It provides for dredging a cut 100 feet wide and 7 feet deep at mean low water at the mouth, and for dredging a channel to the same depth in the river from Stony Point to the Nail Works Bridge, the widths to be 100 feet to Broad Street Bridge, thence 75 feet to the Commerce Street Bridge, and thence 60 feet to the Nail Works Bridge, at an estimated cost of $55,800, which is the amount appropriated.

The range of tides at the mouth is about 5½ feet, and at Bridgeton is nearly 7 feet, which was practically all the available depth along the wharves of the town.

The gas and water mains obstructing the channel at Bridgeton having been removed, the channel was dredged between August, 1907, and February, 1908, from deep water at Stony Point to the nail works, the depth made being 8 feet at mean low water—which included 1 foot for overdepth allowed under the contract—100 feet wide to Broad street, 75 feet wide thence to Commerce street, and 60 feet wide thence to the Nail Works Bridge.

No work was done during the past fiscal year. The expenditures were for inspection and supervision expenses.

The maximum draft that could be carried on June 30, 1909, at mean low water over the locality under improvement was 7 feet to head of navigation except that only 5 feet draft was available over the bar at the mouth.

No work can be done at the mouth until title has been secured to a tract of land needed for a cut-off. Negotiations for the transfer to the United States of this land free of cost have been in progress for some time, but owing to legal obstacles have not yet been consummated.

The amount expended on this improvement under the present project to June 30, 1909, is $23,156.67, of which $52.78 was for maintenance. About 40 per cent of the projected work has been done.

The commerce for the calendar year 1908 is reported to have been 51,817 tons, valued at $371,600.

It is proposed to expend the funds recommended below in maintenance of the improvement to extend the benefits and to make them available at all stages of the tide.

July 1, 1908, balance unexpended	$32,696.11
Received from sales	100.00
	32,796.11
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	52.78
July 1, 1909, balance unexpended	[a] 32,743.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	6,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix I 6.)

7. *Tuckerton Creek, New Jersey.*—This is a tidal stream flowing into Little Egg Harbor, on the Atlantic coast, northeast of Atlantic City. A preliminary examination and survey of the creek were made, and a report recommending its improvement is printed in Annual Report of the Chief of Engineers for 1900, pages 1612–1615.

The original low-water depth at Tuckerton, the head of navigation, was 15 inches, which increased gradually to 4 feet at the mouth of the creek, a distance of 2 miles. From the mouth of the creek across the flats to Gaunts Point, seven-eighths of a mile, the low-water depths were 2 to 2½ feet. The mean tidal range is 2½ feet.

The existing project, adopted by the river and harbor act of June 13, 1902, contemplates the dredging of a channel 6 feet deep at mean low water and 80 feet wide from Gaunts Point, seven-eights of a mile, to the mouth of the creek; thence a channel of the same depth and 75 feet wide, 1 mile, to Parkers Landing; thence a channel of the same depth and 60 feet wide, five-eighths of a mile farther, to West Tuckerton Landing; thence a channel 5 feet deep at mean low water and 60 feet wide for three-eighths of a mile to just above Scow Landing, and thence a channel 3 feet deep at mean low water and 40 feet wide for one-eighth of a mile to the milldam at Tuckerton, together with the widening of the channel at sharp bends; the channel across the cove between the mouth of the creek and Oyster Bed Point to be supplemented, if necessary, by a revetment wall along its northern side. The estimated cost of the work, including contingencies, is $61,380. Under authority contained in the river and harbor act of March 3, 1905, the Secretary of War authorized the location of the channel at the mouth to be changed so as to lead it in a south-southeast direction directly to the deep water at the head of Marchelder channel instead of to Gaunts Point.

The channel has been dredged to the project widths from the mouth of the river to a point 2,100 feet below the milldam at Tuckerton, the depth made being 6 feet at mean low water, except the upper 581 feet, which was dredged to 5 feet at mean low water. This completed about one-half of the project.

The river and harbor act of March 2, 1907, appropriated $12,000 for continuing the improvement, and a project for the expenditure of the appropriation was duly approved by the Chief of Engineers.

---

[a] In addition to this balance the sum of $6,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

This included dredging of the cut from the mouth of Tuckerton Creek to the Marchelder channel. It was then found, however, that dredging along that line would destroy several oyster beds held and owned by private parties under leases from the State of New Jersey, and it was therefore concluded to defer operations until this matter could be adjusted.

Under date of December 16, 1907, the chief of the bureau of shell fisheries of the State of New Jersey advised this department that all objection to the proposed dredging had been removed, and thereupon contract for the dredging was entered into. The contract provided for dredging a straight channel from deep water of Marchelder channel, off Parkers Island, across the flats of Little Egg Harbor to the mouth of Tuckerton Creek, passing through the point on the southwest side of the mouth, and then dredging, as far as the available funds would permit, the upper river, the depths to be 5 feet at mean low water from Marchelder channel to Scow Landing, and thence 3 feet to the milldam.

The contractor's plant arrived at the lower end of Marchelder channel on June 19, 1908, and to the end of July only 1,048 cubic yards of material had been dredged, and no work was done thereafter. On September 10, 1908, the contract was annulled. New proposals for the dredging were opened October 30, 1908, but as the prices bid were excessive the bids were rejected.

The river and harbor act of March 3, 1909, provided $2,000 for maintenance of this improvement, and proposals were then invited for dredging with the entire amount available, but no bid was received. Proposals were again invited upon revised specifications and these are to be opened July 8, 1909.

The maximum drafts that could be carried on June 30, 1909, at mean low water over the locality of the improvement were 2 feet from the milldam to Scow Landing, 4 feet thence to West Tuckerton, 5½ feet thence to Parkers, 6 feet thence to the mouth, and thence 2½ feet to the head of Marchelder channel.

The amount expended on the improvement to June 30, 1909, is $24,846.43, of which $2,215.15 was for maintenance.

The commerce reported for the calendar year 1908 is 26,609 tons, valued at $1,192,898.

The improvement of Tuckerton Creek is not yet sufficiently advanced to show any material decrease in freight rates. Shipments from distant points have, however, been increased and facilitated, although lumber-laden vessels still are obliged to await tides at the flats at the mouth of the creek.

As the project progresses it is believed that cost of maintenance will decrease.

It is contemplated to expend the funds recommended below in dredging for restoring and maintaining the present channel and in completing the work under the approved project to render the improvement available.

July 1, 1908, balance unexpended	$12,033.09
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	2,000.00
	14,033.09
June 30, 1909, amount expended during fiscal year, for works of improvement	879.52
July 1, 1909, balance unexpended	13,153.57
July 1, 1909, outstanding liabilities	118.81
July 1, 1909, balance available	13,034.76
Amount (estimated) required for completion of existing project	27,380.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	31,380.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I 7.)

8. *Cold Spring Inlet, New Jersey.*—This is a new work. The locality is on the coast of New Jersey, about 3 miles east of the city of Cape May. Within the inlet there was originally a natural basin about 6 feet deep and 60 acres in area. In the throat of the inlet the depth was 29 feet at mean low water and on the outside bar there was a minimum depth of 3.5 feet at low water about one-half mile out. There was no commerce.

Improvement of the locality was begun by private parties to enlarge the basin inside the inlet to about 500 acres in area, with a depth of 30 to 40 feet; and to complete the plan for a safe landlocked harbor for commerce and refuge the General Government has undertaken to provide a suitable connection between it and the deep water in the ocean, so as to make the harbor accessible to seagoing vessels.

The plan of improvement adopted by the river and harbor act of March 2, 1907, contemplates providing an entrance channel 25 feet deep at mean low water by construction of parallel jetties 750 to 850 feet apart and dredging between them, at an estimated cost of $1,311,000. The adoption of this project was conditional upon the contribution of $100,000 toward the improvement by local authorities or private parties. This contribution was made by deposit on February 28, 1908, with the assistant treasurer of the United States at Philadelphia, Pa., of $100,000 to the credit of Maj. C. A. F. Flagler, Corps of Engineers, the district engineer officer, by the Cape May Real Estate Company.

All the requirements of the act of 1907 relative to conveyance of land, etc., have been carried out and the deeds of conveyance to the United States approved by the Department of Justice.

The dredging of the harbor is a little more than one-half completed; no work is in progress at present. By an instrument dated December 9, 1908, supplemental to an agreement executed June 25, 1907, the time for the completion of the inner harbor by the Cape May Real Estate Company is extended to September 30, 1910.

The report of survey upon which the plan of improvement is based is printed in House Document No. 388, Fifty-ninth Congress, second session.

On October 3, 1907, proposals were opened for the required jetty work and award made to the lowest bidder, the Seacoast Construction Company, of New York. This company, however, failed to execute the contract required, and later, upon evidence that it had been merged into the Breakwater Construction and Engineering Company, a contract, dated January 18, 1908, was entered into with that company on the bid submitted by the Seacoast Construction Company, the work to be commenced within sixty days and completed within two years and two months after notification of approval of the contract, which was received by the company on April 20, 1908.

The United States work at this point is under a continuing-contract appropriation; the balance of the authorization remaining to be appropriated is $379,800.

Work under the contract was begun at the site on July 29, 1908, by the Breakwater Company, the legal assignee and successor of the Breakwater Construction and Engineering Company, and to the end of the fiscal year about 29 per cent of the contract work had been done. In the west pile, brush, and stone jetty and in the wing of that jetty the piling had been placed, and in the pile, brush, and stone wing of the east jetty 369 piles had been driven. About 75,079 net tons of stone had been deposited in the east and west jetties.

Under date of May 13, 1909, the Acting Secretary of War approved supplementary articles of agreement entered into with the Breakwater Company for the omission of the lower wales and the substitution of brush in place of stone to a varying height of from half tide to high water for the purpose of deflecting and directing the tidal current and facilitating the work of scouring a channel through the bar of sufficient depth to allow the passage of barges of stone for filling the jetty, in consideration of which the Breakwater Company allows the United States a rebate of $1,170 and a deduction of $1.75 for each cubic yard of stone replaced by brush.

The range of tide at the inlet is 4½ feet.

The amount expended on the improvement to June 30, 1909, is $120,246.37, of which $2,800.41 was from funds contributed by the Cape May Real Estate Company.

July 1, 1908, balance unexpended	$628, 979. 58
Amount appropriated by sundry civil act approved March 4, 1909	284, 000. 00
	912, 979. 58
June 30, 1909, amount expended during fiscal year, for works of improvement	[a]102, 025. 95
July 1, 1909, balance unexpended	810, 953. 63
July 1, 1909, outstanding liabilities	43, 160. 00
July 1, 1909, balance available	[b]767, 793. 63
July 1, 1909, amount covered by uncompleted contracts	486, 930. 00
Amount (estimated) required for completion of existing project	379, 800. 00

(See Appendix I 8.)

---

[a] United States funds, $99,225.54; private contribution, $2,800.41.

[b] United States funds, $712,766.77; private contribution, $55,026.86.

9. Wilmington Harbor, Delaware.—The harbor of Wilmington, Del., is in the Christiana River and includes a length of about 4 miles above its mouth at the Delaware River. It also includes the navigable portion of the Brandywine River (2 miles), which flows into the Christiana River at a point about 1¾ miles above its mouth.

Previous to 1836, when the first appropriation for the improvement of the Christiana River was made, the low-water depth at the entrance to this stream was about 8½ feet. The minimum depth in the channel in the portion of the river below Third Street Bridge, Wilmington, was 8 feet. This depth was increased in 1836 by dredging to 10 feet below low water, and under projects of 1871 and 1881 to 12 and 15 feet, respectively.

The present project is based upon a survey made in 1895 and adopted in river and harbor act of June 3, 1896. It provides for the formation, by dredging, rock removal, and construction of dikes, of a channel in the Christiana River 21 feet deep at mean low water from that depth in the Delaware River to the pulp works, a distance of about 4 miles, and thence diminishing to a depth of 10 feet at mean low water to the draw pier of the Philadelphia, Baltimore and Washington Railroad cut-off bridge No. 4, the width at bottom varying between 250 feet at the mouth and 200 feet at bridge No. 4. The project further provides for the removal of shoals from bridge No. 4 to Newport to a depth of 7 feet at mean low water. This project was completed in 1906. The depth made over the rock ledges just above and below the Third Street Bridge is about 21½ feet.

Further work contemplated is for maintenance of the improvement.

Under an act of the legislature of the State of Delaware approved March 9, 1901, authorizing and requiring the city of Wilmington to contribute to the extent of 10 per cent of the amount expended by the United States Government, for the improvement of Wilmington Harbor, the sum of $4,400.54 was expended by the city of Wilmington in October and November, 1906, in dredging the channel between the Third Street Bridge and the Market Street Bridge, resulting in a continuous channel 75 feet wide and 17 feet deep at mean low water between the points named, and connecting them with the channel dredged by the General Government. This work was done under the supervision of the local United States engineer officer.

The city of Wilmington also, under the state law above referred to, appropriated the further sum of $6,567.41 as its contribution for the fiscal year 1909 for the improvement of Wilmington Harbor, but this money has not been expended or turned over for expenditure to the local United States engineer officer, as required by the state act, although readiness to expend it was expressed by him. This appropriation lapsed on June 30; an equal amount has similarly been appropriated for the fiscal year 1910, but no indications of its transfer or other expenditure have become manifest, although the local United States engineer officer has brought to the attention of the city authorities the urgent necessity therefor.

In 1907 slight repairs were made to the jetties at the mouths of the Brandywine and Christiana rivers.

Under contract completed July 16, 1908, the channel was dredged to a depth of 19 feet and a width of 250 feet from the 18-foot depth in Delaware River to a point about 1,200 feet above Lobdells Canal, and 200 feet wide and 19 feet deep at mean low water from a point opposite

Harlan & Hollingsworth's dry dock to a point about 150 feet above Market Street Bridge; and under a contract completed in November, 1908, the channel was dredged to a depth of 19 feet and width of 100 feet from the Pennsylvania Railroad cut-off bridge No. 3 to the mouth of the Brandywine, and from Third Street Bridge to Market Street Bridge to a depth of 18 feet and width of 100 feet, the depths made including 1 foot for overdepth allowed under the contract.

On April 2, 1909, the Chief of Engineers allotted $40,000 from the appropriation made by the river and harbor act of March 3, 1909, for preservation and maintenance of river and harbor works, and contract has been made for dredging with the available funds Work under this contract was begun on June 11, and to the end of the fiscal year a length of 3,325 feet in the lower part of the river had been dredged to a depth of 19 feet at mean low water and a width of 150 feet.

On June 30, 1909, the condition of the channel was as follows: From the Delaware River to the Christiana light a depth of 17 feet at mean low water for a width of 150 feet; thence to Lobdells Canal 11 feet at mean low water for a width of from 100 to 250 feet; thence to Fourth street wharf 18 feet for a width of 90 to 180 feet; thence to Third Street Bridge 10 feet for a width of 200 feet; thence to Market Street Bridge 15 feet for a width of 200 feet; thence to Harlan & Hollingsworth Corporation's dry dock 18 feet for a width of from 100 to 150 feet; thence to the pulp works 12 feet for a width of about 80 feet; and thence to Newport 6 feet for a width of about 80 feet.

Between July 10 and 17, 1908, eighteen stumps and logs and parts of two wrecks were removed from the channel of the upper Christiana River above Churchman's bridge, at a cost of $265.98, with an allotment approved by the Secretary of War June 12, 1908, from the appropriation for emergencies made by the river and harbor act of March 2, 1907.

The maximum draft that could be carried on June 30, 1909, at mean low water over the part of the river under improvement was 13.5 feet to the pulp works and 6 feet thence to Newport. The stream is navigable to about one-fourth mile above the village of Christiana, or 15½ miles from the mouth. The tidal range at the mouth is slightly over 6 feet and at Christiana village about 3.6 feet.

The amount expended on this improvement from 1836 to June 30, 1909, is $994,403.96. Of this amount $592,282.75 was expended on the present project, of which $148,631.12 was for maintenance. This is exclusive of $500.69 expended from appropriation for emergencies in removal of obstructions from the channel above Churchman's bridge.

The tonnage of the leading articles shipped to and from the port of Wilmington in the calendar year 1908 is reported to have been 738,403 tons, valued at $61,026,414.

The shipbuilding industry on the river is quite extensive, the records of the Department of Commerce and Labor showing that, with the exception of Philadelphia and Newport News, Wilmington has the largest steel shipbuilding output on the Atlantic coast for the ten years ending June 30, 1905.

The harbor improvements do not directly affect freight rates on light-draft boats to any extent. Shipments thereon made by water range about 25 per cent lower in rate than by rail, but much more in deep-draft vessels, of which there are many, covering shipments to and from the manufacturers and shipbuilding plants.

It is proposed to expend the funds recommended below in maintenance of the improvement in restoration of an 18-foot channel on project widths in the lower harbor and restoration of project depths and widths in the upper harbor to Newport, and in repairs to the superstructure of the north jetty at the mouth of the Christiana River, all in extending the benefits to navigation.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$34, 142. 53
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	40, 000. 00
Received from sales	426. 26
	74, 568. 79
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	25, 077. 68
July 1, 1909, balance unexpended	49, 491. 11
July 1, 1909, outstanding liabilities	4, 500. 00
July 1, 1909, balance available	44, 991. 11
July 1, 1909, amount covered by uncompleted contracts	30, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	280, 000. 00

EMERGENCIES IN RIVERS AND HARBORS.

July 1, 1908, balance unexpended	$1, 015. 19
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	265. 88
June 30, 1909, amount returned to Treasury to credit of appropriation	749. 31

(See Appendix I 9.)

10. Appoquinimink, Murderkill, and Mispillion rivers, Delaware.—(*a*) *Appoquinimink River.*—At the time of the adoption of the present project there was a mean low-water depth of 2 feet at the entrance into Delaware Bay, and the shoalest depth inside the river was 4½ feet. The most serious obstructions to the navigation of the river were the many bends in the lower and middle sections.

The approved project is based upon a survey made in 1889, and adopted by Congress in river and harbor act of September 19, 1890. It provides for a channel 8 feet deep at mean low water, having a width of 80 feet from the bridge at Odessa to New bridge, near Townsend's wharf, a distance of 3¼ miles, and a width of 100 feet from this wharf to the mouth of the river, a distance of 5 miles. The estimated cost of the improvement is $39,963.

A history of the work done up to June 30, 1905, may be found in the Annual Report of the Chief of Engineers for 1905, pages 175–176.

With $5,500 allotted by the Secretary of War in 1905 from the appropriation made by the river and harbor act of March 3, 1905, for improving Appoquinimink, Murderkill, and Mispillion rivers, a cut-off was made through the neck of land on the left bank of the river leading to Fennimore's (or New) bridge, about halfway between the mouth and Odessa. This cut-off shortened the channel distance by 2,272 feet, the distance between Odessa and the 7-foot contour in Delaware Bay being now about 6¾ miles.

Under the provisions of the river and harbor act of March 2, 1907, the Secretary of War, on March 20, 1907, approved an allotment of $6,400 for expenditure on this improvement. Of this amount $5,000 pertained to the act referred to and the remainder was funds pertaining to former allotment. With these funds the channel has been dredged to not less than 7 feet deep at mean low water and 50 feet wide between Odessa and the mouth. No work was done during the year. The expenditure was for supervision expenses.

The maximum draft that could be carried on June 30, 1909, at mean low water in the river was 6½ feet, and across the flats at the mouth 4 feet. The range of tide is 6 feet at the mouth and 3½ feet at Odessa.

The stream is navigable for small craft to Noxentown milldam, about 4 miles above Odessa, making the navigable portion of the stream 10¾ miles long now.

The amount expended on the improvement to June 30, 1909, is $41,182.65, of which $9,140.24 was for maintenance.

About three-fifths of the work on the project has been completed.

The commerce of the river for the calendar year 1908 is reported to have been 30,975 tons, valued at $1,942,325.

The freight rates, it has been reported, remain about the same, but the passenger business has increased in consequence of the improvement of the river.

Under date of June 29, 1909, the sum of $5,000 was allotted from the appropriation made by the river and harbor act of March 3, 1909, to be applied to the maintenance of the improvement, and to utilize the available funds bids for dredging operations will be opened soon.

It is proposed to expend the funds recommended below in completing, to project dimensions, the channel of the river and in maintenance work, for an extension of the benefits to navigation.

July 1, 1908, balance unexpended	$1,422.77
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	5,000.00
Received from sales	150.00
	6,572.77
June 30, 1909, amount expended during fiscal year for maintenance of improvement	8.51
July 1, 1909, balance unexpended	6,564.26
Amount (estimated) required for completion of existing project	7,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

---

[a] See consolidated money statement on page 219.

(*b*) *Murderkill River*.—This river is a tidal stream and a tributary of Delaware Bay and flows through Kent County, Del. Its navigable portion is about 9 miles long. The condition of the river was fair for the greater part of its length, the average width and depth being 90 and 6 feet, respectively. Outside the junction with Delaware Bay, however, there was a serious obstruction—the flats, which are nearly bare at low tide and extend for nearly a mile from the shore. The average rise and fall of the tide at the mouth is 4.6 feet and 2½ feet at Frederica.

In 1881 an examination of this river was made and a project submitted for its improvement. No appropriation was made by Congress, however, as the river was at that time in the hands of an improvement and navigation company chartered by the State. This company had expended about $10,000 in rectifying the many bends of the river by cutting straight canals and in dredging a narrow cut across the flats at the mouth. The latter slowly filled up again.

Under the provisions of the river and harbor act of September 19, 1890, a survey was made, and report thereon is printed in House Executive Document No. 21, Fifty-second Congress, first session.

The project for improvement, which was adopted in the river and harbor act of July 13, 1892, is for a 7-foot low-water channel, 80 feet wide from the town of Frederica, at the head of navigation, to the mouth of the river, 8 miles, and 150 feet wide from the mouth, across the flats outside to the 7-foot curve of depth in Delaware Bay, the cut at the mouth to be protected by forming an embankment of the dredged material on each side, the estimated cost being $47,550.

Dredging for original work and for maintenance has been done at different times since 1893. A history of operations to June 30, 1905, will be found in the Annual Report of the Chief of Engineers for 1905, pages 177–178.

With funds derived from the river and harbor appropriations of March 3, 1905, and March 2, 1907, and emergency appropriations of 1905 and 1907, the river has been dredged at various points and across the flats at the mouth, resulting in a channel not less than 50 feet wide and 6 feet deep at mean low water from Frederica to the 6-foot curve in Delaware Bay.

About 50 per cent of the project has been completed.

With an allotment of $3,000 from the emergency appropriation provided by the river and harbor act of March 2, 1907, the channel was redredged in 1908 across the flats at the mouth and in the river, resulting in a continuous channel at least 6 feet deep at mean low water and at least 50 feet wide from Frederica to the 6-foot curve in Delaware Bay.

The maximum draft that could be carried on June 30, 1909, at mean low water in the part of the river under improvement is 5 feet from Frederica to the mouth and 5 feet across the flats to Delaware Bay.

Under date of May 1, 1909, the sum of $7,000 was allotted from the appropriation for preservation and maintenance made by the river and harbor act of March 3, 1909, and on July 2, 1909, proposals are to be opened for dredging therewith at the mouth and in the river.

The amount expended on this improvement to June 30, 1909, is $50,279.01, of which $26,918.23 was for maintenance.

The commerce of the river, which is quite varied, is reported for the calendar year 1908 as 29,478 tons, valued at $1,158,800.

As to the effect of the improvement of this stream upon freight rates, it is reported that rates by water are 25 to 50 per cent lower than by rail, and that in winter, when the boats can not run, the railroad increases its rates.

It is proposed to expend the funds recommended below in dredging the channel to full project dimensions as far as possible and in maintenance work for the purpose of extension of benefits.

July 1, 1908, balance unexpended		$3,674.35
Amount allotted from appropriation made by river and harbor act approved March 3, 1909		7,000.00
		10,674.35
June 30, 1909, amount expended during fiscal year for maintenance of improvement	$2,941.38	
Returned to credit appropriation for emergencies in river and harbor works	61.49	
		3,002.87
July 1, 1909, balance unexpended		7,671.98
Amount (estimated) required for completion of existing project		23,264.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		([a])

(*c*) *Mispillion River.*—This river is a tidal stream which enters Delaware Bay about 17 miles northwest of Cape Henlopen. It is navigable for about 13 miles. The mouth of the river was greatly obstructed by a flat foreshore without a channel. Vessels could enter and depart only at high water, the tidal range being about 4 feet.

The river from Milford, the head of navigation, to the mouth was improved by the General Government between the years 1879 and 1889; $17,000 was expended in making a channel 40 feet wide and 6 feet deep at mean low water. Its further improvement was carried on to November, 1906, under a project adopted in the river and harbor act of July 13, 1892. This resulted in a channel 40 feet wide and 4½ feet deep at mean low water from Milford to the mouth and 50 feet wide and 5 feet deep thence to the 5-foot contour in Delaware Bay; and two jetties at the mouth, one, the north jetty, extending from the east bank of the river a length of 1,645 feet, and the other, the south, or Green Point, jetty, extending from Green Point, just below the mouth of Cedar Creek, a distance of 1,100 feet, 500 feet of the outer end being parallel to and 100 feet distant from the axis of the dredged channel, and 200 feet from the north jetty.

The present project was adopted in the river and harbor act of March 2, 1907, and is based upon the report printed in House Document No. 102, Fifty-sixth Congress, second session. This provides for dredging the channel 6 feet deep at mean low water and 60 feet wide, increasing to 75 feet at sharp turns, from Milford to the mouth and thence 4 feet deep and 150 feet wide across the flats, and the construction of a jetty along the south side of the channel, at an estimated cost of $87,065.

---

[a] See consolidated money statement on page 219.

From the appropriation made by the act of March 2, 1907, for improving the Appoquinimink, Murderkill, and Mispillion rivers, Delaware, $40,000 was allotted for the Mispillion, with which an extension has been built to the south jetty, 2,200 feet long, parallel to and 100 feet distant from the axis of the channel, and extending in a southeasterly direction into a natural depth of 2 feet at mean low water on the flats of Delaware Bay. Under a contract for dredging which was completed in July, 1908, the operations resulted in a channel not less than 5 feet deep at mean low water and 50 feet wide from the 4-foot curve in Delaware Bay to the light-house, and not less than 6 feet deep and 40 feet wide thence to the electric light works in the town of Milford. The depth made includes 1 foot overdepth made under the contract.

About 35 per cent of the project has been completed.

The maximum draft that could be carried on June 30, 1909, at mean low water was 5 feet in the river and 2½ feet across the flats at the mouth. The tide rises 4½ feet at the mouth and 3½ at Milford.

The amount expended to June 30, 1909, is $115,935.83. Of this, $37,545.76 is on the present project, of which $4,339.80 was for maintenance.

Under date of June 17, 1909, the sum of $7,000 was allotted from the appropriation for preservation and maintenance of river and harbor works in the act of March 3, 1909, and it is intended to dredge the channel at the mouth and in the river at an early day.

The commerce of the river for the calendar year 1908 is reported to have been 171,034 tons, valued at $5,107,350.

The effect of the improvement on freight rates is stated to be quite marked, a reduction of an average of 25 per cent being reported; in addition, better and increased transportation facilities are afforded.

It is proposed to expend the funds recommended below in building 1,700 feet of jetty, completing the south jetty to its project length of 5,000 feet, in dredging the channel within the river and across the flats at the mouth to full project dimensions, and in maintaining the channel for the purpose of extending the benefits and making them more available.

July 1, 1908, balance unexpended	$6,794.04
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	7,000.00
	13,794.04
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,339.80
July 1, 1909, balance unexpended	9,454.24
July 1, 1909, outstanding liabilities	26.40
July 1, 1909, balance available	9,427.84
Amount (estimated) required for completion of existing project	51,404.80
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	[a]
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

---

[a] See consolidated money statement on page 219.

CONSOLIDATED.

July 1, 1908, balance unexpended		$11,891.66
Amount allotted from appropriation made by river and harbor act approved March 3, 1909		19,000.00
Received from sales of property		150.00
		31,041.66
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	$7,289.69	
Deposited to credit appropriation for emergencies in river and harbor works	61.49	
		7,351.18
July 1, 1909, balance unexpended		23,690.48
July 1, 1909, outstanding liabilities		26.40
July 1, 1909, balance available		23,664.08
Amount (estimated) required for completion of existing project		82,068.80
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		85,725.00

(See Appendix I 10.)

11. St. Jones River, Delaware.—Before the channel was improved the least practicable low-water depth of water to Lebanon, 12 miles above the mouth, was 4 feet, and thence to Dover, 9 miles farther up the river, only 2½ feet.

The original project, made in 1880, was for a 3-foot low-water channel, 100 feet wide across the bar at the mouth, protected by a jetty, at an estimated cost of $35,000. The project was modified in 1884 so as to include the removal of shoals in the river to a depth of 6 feet at mean low water. Improvements were not begun until 1885. The proposed channel within the river was reported as nearly completed at the close of the fiscal year ending June 30, 1888, $25,000 having been expended.

A modification of the project for the improvement of the entrance was submitted and approved in March, 1889. This modified project provided for a cut across the bar at the mouth from the 6-foot depth inside the river to the corresponding depth outside the bar, the width of the cut to be 100 feet, of which 50 feet in the center was to be dredged to a depth of 6 feet, the remainder to a depth of 3 feet below mean low water. The material was to be deposited on either side of the cut to form training dikes, the outer ends of the dikes to be strengthened with pile revetments. It also provided for a new cut-off across a very sinuous bend in the upper river about 1 mile below Lebanon, near Wharton's fishery. This was substantially completed in 1890. Subsequent operations have been for maintenance.

With funds provided by general and emergency river and harbor acts, dredging has been done at various times between 1889 and June 30, 1905. A history of these operations will be found in the Annual Report of the Chief of Engineers for 1905, pages 181–182.

Operations with funds provided by the river and harbor acts of March 3, 1905, and March 2, 1907, resulted in a continuous channel from Lebanon to Delaware Bay of a minimum depth of 6 feet at mean low water and a width of 40 feet in the river and 50 feet across the flats at the mouth.

With an allotment of $3,000 made from the appropriation for emergencies in river and harbor works, the channel was dredged in June and July, 1908, from the mouth to the 6-foot curve in Delaware Bay and at various points in the river, resulting in a channel 6 feet deep at mean low water from Delaware Bay to Lebanon, which has been for years considered the head of navigation for large vessels, the width made being 40 feet in the river and 50 feet across the flats at the mouth.

The amount expended on the improvement to June 30, 1909, is $63,519.94, of which $22,019.94 is for maintenance.

The maximum draft that could be carried on June 30, 1909, at mean low water between Lebanon and the mouth was 5½ feet and across the flats 5 feet.

The range of tide is 4½ feet at the mouth, 2 feet at Lebanon, and 1.6 feet at Dover, the head of navigation, 17 miles from the mouth.

The commerce of the river for the calendar year 1908 is reported to have been 235,313 tons, valued at $4,486,778. It is stated that the improvements made have reduced freight rates by one-fourth to one-half, besides increasing shipments, especially fruits, which now reach the market in less time and in fresher condition.

A survey of this river was made from its mouth to Dover in 1908, and report thereon will be found in House Document No. 1116, Sixtieth Congress, second session.

Under date of June 11, 1909, the sum of $7,000 was allotted from the appropriation made by the act of March 3, 1909, for preservation and maintenance of river and harbor works, and proposals will be opened July 2, 1909, for expenditure of a part of this money in dredging at the mouth and at places which have shoaled in the river.

It is proposed to expend the funds recommended below in dredging for maintenance of the improvement in an extension of benefits.

July 1, 1908, balance unexpended	$3,008.23
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	7,000.00
	10,008.23
June 30, 1909, amount expended during fiscal year for maintenance of improvement	2,971.67
July 1, 1909, balance unexpended	7,036.56
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	6,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I 11.)

12. Smyrna River, Delaware.—This river was formerly known as Duck Creek. It is a tidal stream flowing easterly into the Delaware River at a point about 26 miles south of Wilmington, Del. The navigable portion of the river was originally about 9 miles long; the minimum mean low-water depth over shoal places was 2½ feet in the river and 4 feet at the bar where it enters the Delaware River. The mean range of tide at the mouth is nearly 6 feet, while at Smyrna Landing it is about 3 feet.

In 1878 a project was made for the improvement of the whole river, including the channel across the bar at the mouth. By direction of Congress the improvement of the bar was commenced first, and during the following four years three appropriations, aggregating $10,000, were expended in dredging a channel 100 feet wide and 8 feet deep at mean low water across the bar. The dredged channel soon filled up again.

A new project was adopted in the river and harbor act of August 11, 1888, with a view of obtaining a channel of 7 feet depth throughout, width of 60 feet in the river and 100 feet at the bar, the channel over the bar to be protected by a stone jetty. The estimated cost of the improvement was $90,698.40. Of this $37,365.20 was for dredging and $53,333.20 for the jetty. This act made the first appropriation for work on the project and was, by its terms, to be applied to dredging only. The subsequent appropriations for continuing the improvement have also been applied to dredging.

The entire length of the channel, except at the mouth of the river, was dredged in parts at various times between 1888 and 1900 to the approved dimensions.

In 1904 the channel was dredged to a width of 50 feet and a depth of 6 feet at mean low water from the 6-foot curve just inside the mouth to the 6-foot curve in Delaware Bay, and in 1905, with an appropriation of $15,000 made by the river and harbor act of June 13, 1902, as modified by the act of March 3, 1905, two cut-offs were made extending from just below Limekiln wharf to the turn just above Brick store wharf, an aggregate length of 4,795 feet. Some shoals in the river and the channel across the flats at the mouth also were dredged, resulting in a channel 7 feet deep at mean low water from Smyrna Landing to the 7-foot curve in Delaware Bay, the widths being 60 feet through the cut-offs, not less than 50 feet in the river, and 100 feet across the flats at the mouth. This work at the mouth completed the dredging required under the approved project.

In 1906 and 1907 the channel in the river was dredged, resulting in a channel width not less than 50 feet nor less than 6 feet depth from Smyrna Landing to the 6-foot depth in Delaware Bay, except in the Cherry Tree reach, about halfway between Smyrna Landing and the mouth, where the depth was only 5 feet; and in May and June, 1908, the channel was dredged from inside the river at the mouth to the 7-foot depth in Delaware Bay to a depth of not less than 7 feet at mean low water and a width of 100 feet. This depth included 1 foot overdepth allowed under the contract.

No work was done during the past fiscal year. The expenditures were for payment of outstanding liabilities and supervision expenses.

The maximum draft that could be carried on June 30, 1909, at mean low water was 5 feet in the river and 6 feet across the flats at the mouth. The navigable length was about 10 miles.

The amount expended on the improvement to June 30, 1909, is $71,295.45. Of this amount $61,295.45 is on the present project, of which $16,210.67 was for maintenance.

The commerce for the calendar year 1908 is reported to have been 203,080 tons, valued at $5,047,000.

A survey was made of the river in 1907, and a report thereon will be found in House Document No. 815, Sixtieth Congress, first session.

Under date of June 9, 1909, the Chief of Engineers allotted $6,500 from the appropriation for preservation and maintenance of river and harbor works made by the act of March 3, 1909, and proposals are to be opened on July 2, 1909, for its expenditure in redredging the cut across the flats at the mouth and certain shoals which have formed in the river.

It is proposed to expend the funds recommended below in dredging for maintenance of improvement in extension of benefits.

July 1, 1908, balance unexpended	$2,282.16
Amount allotted from appropriation made by river and harbor act approved March 3, 1909	6,500.00
	8,782.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,269.98
July 1, 1909, balance unexpended	6,512.18
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	7,500.00

(See Appendix I 12.)

13. Broadkill River, Delaware.—In its original condition the depth of water in the river was from 3 to 4 feet at the numerous shoals which impeded navigation. The depth at the mouth was from 1½ to 2 feet at low water.

Prior to the adoption of the existing project $35,000 was expended in providing a channel within the river 6 feet deep and 40 feet wide at low water from the mouth to Milton, the head of navigation.

The existing project was adopted in the river and harbor act of March 2, 1907, and is based upon report and estimate submitted in House Document No. 214, Fifty-ninth Congress, second session. It provides for the establishment of a permanent entrance at the mouth of the river by dredging a channel from the 6-foot curve in Delaware Bay to the same depth in the river and constructing a jetty on the north side of this channel. The estimated cost of the project is $33,330.

The range of the tide is 4.1 feet at the mouth, 3.6 feet at the drawbridge, and 3.4 feet at Milton.

The act of March 2, 1907, appropriated $33,330, the amount estimated for the establishment of a permanent entrance at the mouth of the river, including the construction of a jetty on the north side of the channel. The title papers conveying to the United States the land required for the cut to be made across Lewes Cape have been approved by the Department of Justice; the jetty across Lewes Cape and Lewes Sound from the 6½ to 7 foot depth in Delaware Bay to the high-water line in the marsh of Lewes Sound on its western side, a total length of 1,263 feet, was completed in November, 1908; and a channel 6 feet deep and 150 feet wide at bottom was dredged from the 6-foot depth in Delaware Bay to the same depth in Lewes Sound. This work was done under contract.

Under date of October 20, 1908, the Secretary of War allotted $4,500 from the emergency appropriation and on December 16, 1908, a further sum of $3,200, to be applied to the restoration of a portion of the jetty, which was becoming undermined, and $7,282.67 thereof was applied to the work, which was completed in April, 1909. In addition, a fender wale was placed under the wale pieces for a length of 1,104 feet, for the protection of the jetty from passing boats, at a cost of $250.

The maximum draft that could be carried on June 30, 1909, at mean low water over the cut under improvement, was 4 feet. The whole of the projected work has been completed.

The effect of the improvement on freight rates by water has not yet been reported.

The amount expended on the improvement to June 30, 1909, is $75,658.61, of which $40,658.61 is on the present project. Of the latter amount, $7,532.67 was expended for maintenance.

The commerce during the calendar year 1908 is reported to have been 35,122 tons, valued at $750,825.

Under date of June 28, 1909, the sum of $3,000 was allotted from appropriation made by river and harbor act of March 3, 1909, for preservation and maintenance of river and harbor works, to be applied to the maintenance of the improvement, and with the available funds work at the mouth of the river will be commenced soon.

It is proposed to expend the funds recommended below in dredging and repairing the jetty for the maintenance of the improvement at the mouth to extend the benefits and to make the improvement more completely available.

July 1, 1908, balance unexpended		$25,669.73
Allotted from emergency appropriation, river and harbor act March 2, 1907		7,700.00
Amount allotted from appropriation made by river and harbor act approved March 3, 1909		3,000.00
Received from sales of river and harbor property		100.00
		36,469.73
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$25,465.67	
For maintenance of improvement	7,532.67	
Returned to credit of appropriation for emergencies in river and harbor works	167.33	
		33,165.67
July 1, 1909, balance unexpended		3,304.06
July 1, 1909, outstanding liabilities		42.00
July 1, 1909, balance available		3,262.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of balance unexpended July 1, 1909		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix I 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year wrecks were removed and examined as follows:

Wreck of schooner Florence I. Lockwood, lying sunk in channel off the end of the town of Chincoteague, Va.—It was removed at a cost of $885.02.

Wreck of steamship Gulf Stream, lying sunk in the Atlantic Ocean at entrance to Hereford Inlet, New Jersey.—It was removed at a cost of $1,567.49.

Wreck of barge Homeward Bound, lying sunk in Mantua Creek, New Jersey.—It was removed at a cost of $312.80.

Wrecks of barges Sally and Bennie, lying sunk in Oldmans Creek, New Jersey.—They were removed at a cost of $453.61.

Wreck of schooner Adeline Townsend, reported to be off the capes of Delaware, within the 3-mile limit.—It having been ascertained upon investigation that this wreck was not a menace to navigation, the work of removal was not undertaken, and no expenditure was made from the permanent indefinite appropriation.

Wreck of steam yacht Viva, lying sunk in Absecon Inlet, New Jersey.—It was removed at a cost of $155.20.

A sunken barge (name not given) was reported three-fourths of a mile from shore off Ocean City, N. J., by commanding officer of revenue cutter *Mohawk*, and the Secretary of the Treasury was informed August 8, 1908, that the War Department would be pleased to have it destroyed by a vessel of the Revenue-Cutter Service, at expense of the War Department. No further report received.

The expenditures during the year amounted to $3,374.12.

(See Appendix I 14.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH THE RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination and survey of Oldmans Creek, New Jersey.*—Reports dated May 29, 1907, and October 3, 1908, respectively, are printed in House Document No. 1083, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $89,500 is presented.

2. *Preliminary examination and survey of St. Jones River, Delaware, from its mouth to Dover.*—Reports dated April 26, 1907, and April 8, 1908, respectively, are printed in House Document No. 1116, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $181,425 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE BALTIMORE, MARYLAND, DISTRICT.

This district was in the charge of Maj. W. E. Craighill, Corps of Engineers. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. *Patapsco River and channel to Baltimore, Md.*—Before operations were begun by the United States a controlling depth of 17 feet was available, with a mean range of tide of a little over 1 foot. Vessels over that draft were obliged to lighter portions of their cargoes about 14 miles below to permit them to reach the wharves of the city. There were pockets where deeper water prevailed, but these were unconnected by any channel, natural or artificial. Under the original

project, dated April 15, 1853, for a channel 22 feet deep at mean low water and 150 feet wide, the Fort McHenry channel was dredged, extending from the limits of the city of Baltimore to a point just below Fort Carroll, and the Brewerton channel from this point to deep water of Chesapeake Bay off Swan Point. The cost was $390,000.

In 1871 the project was enlarged to a width of 400 feet at the lower end of the channel, diminishing to 250 feet at its upper end, with a mean low-water depth of 24 feet. Meantime it had been found that the portion of the Brewerton channel which was swept across by the current of the Susquehanna River was continually obstructed by sedimentary deposit. This led to a search for a better location for a deep channel which could be made and maintained by dredging and the natural currents. This was found in the position of the resultant of the two great forces made by the currents of the Susquehanna and Patapsco rivers. The new channel had also the advantage of being shorter by several miles, and for this reason and the very much diminished sedimentary deposit the cost of maintenance was much lessened. In 1892 a project for 27 feet depth at mean low water, with a width of 600 feet in the straight sections and over 1,200 feet in the angles, was completed. At the same time the portion of the Brewerton channel between the upper end of the present cut-off and the point of intersection of the Brewerton and Craighill channels was abandoned because of the sedimentary deposit from the Susquehanna sweeping across it and to shorten the channel still further and lessen the cost of maintenance. The act of June 3, 1896, authorized the increase of the depth of the channel to 30 feet at mean low water, with a bottom width of 600 feet, widened at the angles, and with side slopes of 3 base to 1 vertical. This was completed May 22, 1903, and has since been maintained. The amount expended on original and modified projects prior to operations under existing project is $4,776,269.48, of which $32,797.72 was for maintenance.

The existing project, adopted by Congress March 3, 1905, provides for a channel 35 feet deep at mean low water and 600 feet wide at bottom, with side slopes of 3 base to 1 vertical from Fort McHenry to deep water in Chesapeake Bay above Sandy Point light-house and through the shoals opposite York Spit, at an estimated cost of $3,465,000. This project was extended by the act of March 3, 1909, to include the widening of the Fort McHenry division near its intersection with the Curtis Bay channel, so as to provide an anchorage basin 600 feet wide and about 3,500 feet long with project depth, within the limit of the original estimate. Dredging began July 5, 1905, and has resulted in a channel of the project dimensions from Fort McHenry to deep water in Chesapeake Bay and in the eastern half of the section opposite York Spit. The anchorage basin in the Fort McHenry division is just begun. In the western half of the York Spit channel a least depth of 32½ feet has been obtained. An appropriation of $500,000 was made in the river and harbor act of March 2, 1907, and work was authorized under continuing contracts for completion to an additional amount of $1,715,000, all of which has been appropriated. Proposals for this work were opened July 1, 1907, and a continuing contract made for completing the project. An additional contract for the Fort McHenry channel widening was entered into June 12, 1909. Work under contract has been in progress during the fiscal year with the result that the section near Baltimore was completed. The eastern half (or 300-foot width) of York Spit channel was also completed and opened to navigation in November, 1908; and work on the Fort McHenry channel widening was commenced.

The amount expended on the existing project to the close of the fiscal year ending June 30, 1909, is $2,428,450.33.

The draft that can now be carried to Baltimore, the head of navigation, a distance of 11 miles from the mouth of Patapsco River and 171 miles from the mouth of Chesapeake Bay, is 35 feet at mean low water. The length of dredged channel in Patapsco River and Chesapeake Bay above Sandy Point is about 20 miles; opposite York Spit, about 4½ miles.

The tonnage movement of the port has been as follows:

Fiscal year ending June 30—	Tons.	Fiscal year ending June 30—	Tons.
1889	3,243,017	1900	7,941,580
1890	4,237,361	1901	8,055,017
1891	4,495,469	1902	7,529,870
1892	5,224,042	1903	7,736,447
1893	4,607,176	1904	7,334,241
1894	4,752,946	1905	7,510,713
1895	4,794,964	1906	8,277,098
1896	5,363,894	1907	8,448,203
1897	6,868,120	1908	8,441,034
1898	7,339,405	1909	7,436,273
1899	6,843,620		

The statistics of the port for the past fiscal year are illustrated briefly by the following statement:

Value of commerce; coal, coke, grain, flour, iron, steel, etc	$101,497,626.00
Dutiable imports have decreased	$4,261,706.00
Free imports have decreased	$1,193,062.00
Domestic exports have decreased	$12,283,164.00
Tonnage (foreign and coastwise) has decreased, tons	1,004,761
Duties collected have decreased	$1,298,939.02
Duties on merchandise in bond have increased	$5,570.38
Duties on merchandise in bond with and without appraisement have increased	$1,372,655.99

The effect of the present project upon freight rates can not be ascertained until work is fully completed, but as some of the vessels trading with the port are not now able to load to their full capacity the tendency should be toward cheapening rates when means are provided to enable them to carry full cargoes and to enable other vessels of greater capacity to trade with the port.

References to reports of examinations and surveys are to be found on page 180 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended	$941,755.99
Repaid on account of filling in swamps at Fort Howard, Md	16,830.33
Account of sales at auction	5.00
Amount appropriated by sundry civil act approved March 4, 1909	965,000.00
	1,923,591.32
June 30, 1909, amount expended during fiscal year for works of improvement	867,276.13
July 1, 1909, balance unexpended	1,056,315.19
July 1, 1909, outstanding liabilities	3,501.35
July 1, 1909, balance available	1,052,813.84
July 1, 1909, amount covered by uncompleted contracts	302,068.44

(See Appendix J 1.)

2. *Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.*—With a mean range of tide of a little over 1 foot, there was a controlling depth of 20 feet at mean low water in 1893, when the first improvement was undertaken by the United States. The original project was dated July 15, 1892, and was for a channel 27 feet deep at mean low water and a bottom width of 150 feet, at an estimated cost of $85,000. Forty thousand dollars of the estimate was appropriated, and with this total expenditure the channel was first made 25 feet deep for the project width and then dredged to 27 feet deep for a width of 70 feet in the axis of the 150-foot channel. That project was never completed. It was superseded by a project in the river and harbor act approved June 13, 1902, for deepening the channel to 30 feet and widening it to 250 feet, and authority was granted to make continuing contracts to complete the work. The estimated cost was $196,000.

A continuing contract was approved, and under it dredging was commenced March 5, 1903, and the project completed November 30, 1903.

The amount expended on existing project to June 30, 1909, was $196,012.52, of which $3,329.16 was for maintenance in partially removing some shoaling. This was done under contract. The sum of $9,000 was allotted from the appropriation for preservation and maintenance of river and harbor works contained in the act of March 3, 1909, for restoring the channel to project dimensions.

A contract dated June 8, 1909, was entered into for this work and the work commenced. The $10,000 asked for will be applied to maintenance of the channel where shoaling occurs, the additional work being necessary to make the improvement available to full project dimensions.

Curtis Bay is the mouth of Curtis Creek, which is navigable in fact 5⅛ miles above the head of the channel contemplated by the existing project, but a maximum draft of 28½ feet at mean low water can be carried June 30, 1909, over the shoalest part of the locality under improvement, which is a distance of 2⅙ miles.

It is stated that the improvement has lowered rates upon freight, but the amount of reduction has not been ascertained.

References to reports on examinations and surveys are to be found on page 180 of the Annual Report of the Chief of Engineers for 1904.

This bay is in the collection district of Baltimore and the statistics are attached to the report for that harbor.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$9,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	12.52
July 1, 1909, balance unexpended	8,987.48
July 1, 1909, outstanding liabilities	29.34
July 1, 1909, balance available	8,958.14
July 1, 1909, amount covered by uncompleted contracts	7,920.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix J 2.)

3. Harbor of southwest Baltimore (Spring Garden), Md.—No work was done by the United States before the existing project, but the city of Baltimore dredged a channel from the main ship channel to the foot of Eutaw street, which had a controlling depth of 15 feet at mean low water. The average rise of the tide is a little over 1 foot. In response to a resolution of the House of Representatives an estimate was furnished March 7, 1896 (printed in Annual Report for 1896, p. 1006), of the cost of deepening the channel to a depth of 27 feet. It was for a channel 100 feet wide on the bottom, with side slopes of 1 on 3, from the main ship channel near Fort McHenry to the foot of Eutaw street, with a turning basin 400 feet by 400 feet near the upper end, at an estimated cost of $314,000, which is the existing project. Five thousand dollars was appropriated June 3, 1896, but it was deemed inexpedient to start the work with that small sum. June 13, 1902, $88,000 was appropriated and authority granted to enter into contracts for the completion of the work. A continuing contract was made for the completion of the project, and it was completed April 4, 1905. The sum of $314,000 was expended under the project for improvement, in addition to which $6,512.52 was expended for maintenance. Thirty-four thousand dollars was allotted from the appropriation for preservation and maintenance of river and harbor works, contained in the act of March 3, 1909, for restoring the channel to project dimensions as far as possible. A contract dated June 8, 1909, was entered into and operations begun. The sum of $34,000 more is required to entirely remove shoaling. This channel was dredged in very soft material, where silt has been slowly accumulating for many years. The cost of maintenance for a number of years will probably continue to be large, but after the side slopes have flattened out sufficiently it is thought that the cost of maintenance will be much reduced.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement is 27 feet at the lower end and about 16 feet at the upper end.

The stream is navigable in fact to Baltimore, Md., which is 14 miles from the mouth of Patapsco River and 174 miles from the mouth of Chesapeake Bay. The length of the channel dredged under the existing project is 4 miles. It is stated that the improvement has somewhat lowered freights, but the amount of reduction has not been ascertained.

The commercial statistics of the port of Baltimore include this harbor.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$34,000.00
June 30, 1909, amount expended during fiscal year for maintenance of improvement	12.52
July 1, 1909, balance unexpended	33,987.48
July 1, 1909, outstanding liabilities	14.00
July 1, 1909, balance available	33,993.48
July 1, 1909, amount covered by uncompleted contracts	29,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	34,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 3.)

4. *Elk River, Maryland.*—Before improvements were commenced there was practically no navigation above Cedar Point. The original project, dated June 23, 1874, was for a channel 6 feet deep at low water, or 8 feet at high water, from Cedar Point to Elkton, the head of navigation, and in the Little Elk as far as Bennett's wharf. The mean range of the tide is 2 feet. Such a channel was estimated to cost $36,000 if 75 feet wide and about $25,000 if 50 feet wide, cheap dikes being required for regulating the banks and to provide a place behind which to deposit the material dredged from the shoals. The first work was done in 1874, when $5,000 was expended in building a dike and dredging to a width of 25 feet and a depth of 6 feet at mean low water in front of it and for about 300 feet below. Two years later the channel was made 40 feet wide from the bridge at Elkton to about one-half mile below. In 1884 a channel was completed 80 feet wide through the bar near the mouth of the Little Elk River and 70 feet wide thence to the bridge at Elkton, the depth being 7 feet at mean low water. In 1893 a channel 100 feet wide and 8 feet deep from deep water below Cedar Point to the bridge at Elkton was completed. The expenditure on the original and subsequent projects has amounted to $46,500.

The channel had shoaled, and in a report on a survey made in 1899 (printed on pp. 1668–1669, Pt. 2, Annual Report of the Chief of Engineers for 1900) it was proposed to restore the channel to 8 feet depth at mean low water and 100 feet wide from deep water below Cedar Point to the bridge at Elkton, at an estimated cost of $16,665, with an annual cost of $2,500 for maintenance. The river and harbor act of June 13, 1902, adopted this project, and appropriated $16,665 for the work. This appropriation was practically expended in dredging in the fiscal year ending June 30, 1903. The project width of 100 feet could not be made, as the river was found to have shoaled very much since the survey in 1899, on which the appropriation was based.

The existing project adopted by the river and harbor act of March 2, 1907, is for a channel 6 feet deep at mean low water and 100 feet wide from Elkton to Cedar Point, at an estimated cost of $16,802.77. The act appropriated $18,803 for its completion and maintenance. A contract was entered into and the project completed in March, 1908. Nevertheless extensive shoaling has already taken place and it is doubtful whether the project can be maintained without annual dredging to an extent much greater than was anticipated. The sum of $10,000 is now required.

The sum of $10,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act March 3, 1909, for maintenance and a contract for the work is about to be entered into.

The amount expended on this improvement to June 30, 1909, is $83,968, of which $63,165 was on previous projects, $16,439.24 on present project, and $4,363.76 for maintenance. The amount expended during the fiscal year was for payment of retained percentages on contract work and part of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the river was 3½ feet. The stream is navigable, in fact, to Elkton, Md., which is about 16 miles from the mouth of the river. It was stated that the improvement has materially reduced freight rates.

Reference to a report on a survey is to be found on page 182 of the Annual Report of the Chief of Engineers for 1904. Reference to report on preliminary examination and survey of the river, required by the river and harbor act of March 3, 1905, will be found on page 214 of the Annual Report of the Chief of Engineers for 1906.

The commerce of the river for the calendar year 1908 is reported to be 42,880 tons, consisting of vessels built, cord wood, lumber, fertilizer, hay, and flour, valued at $258,847. Two steam tugs and 171 schooners and barges are reported as plying in the river.

July 1, 1908, balance unexpended	$1,770.67
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	11,770.67
June 30, 1909, amount expended during fiscal year, for works of improvement	1,770.67
July 1, 1909, balance unexpended	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 4.)

5. Susquehanna River above and below Havre de Grace, Md.—The original governing depth was 5 feet at mean low water. The mean range of tide is 2½ feet. The channel above Havre de Grace was narrow and subject to ice gorges. The original project is dated February 22, 1853, and was for a channel 12 feet deep and 100 feet wide, at an estimated cost of $59,000. Improvements have been in progress since 1853, and up to August 22, 1882, when the existing project was adopted, $97,390 had been expended upon them. The existing project is to give a channel 200 feet wide and 15 feet deep at mean low water below Havre de Grace and to remove the shoal opposite Watsons Island (which is above Havre de Grace) to a depth of 8 feet at the same stage of the tide, at an estimated cost of $168,000. The amount expended on that project to June 30, 1909, is $113,184.42, and has resulted in dredging a portion of the channel below Havre de Grace to a depth of 15 feet at mean low water and removing the shoal opposite Watsons Island, completing about three-fifths of the approved project.

The operations during the year resulted in extending the channel to project dimensions for about 4,000 feet.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement is 12 feet. The stream is navigable in fact to Port Deposit, Md., which is about 5 miles above the mouth of the river. The improvement has made no appreciable difference in freight rates. It is proposed to apply funds asked for in continuing work on the project.

Three steamers and 40 sailing vessels and barges are reported as plying in the river, the commerce being valued at $473,933. The tonnage of the river is reported to be as follows: 1905, 135,293; 1906, 73,815; 1907, 85,212, and for 1908, 37,936, consisting of lumber, cement, salt fish, granite, stoves, castings, etc

July 1, 1908, balance unexpended	$19,969.97
June 30, 1909, amount expended during fiscal year, for works of improvement	19,654.39
July 1, 1909, balance unexpended	315.58
Amount (estimated) required for completion of existing project	54,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	54,500.00

(See Appendix J 5.)

6. *Harbors at Rockhall, Queenstown, Claiborne, and Cambridge, and Chester, Choptank, Warwick, Pocomoke, La Trappe, and Manokin rivers, and Tyaskin Creek, Maryland*—(*a*) *Rockhall Harbor and inner harbor at Rockhall.*—In 1894 the controlling depth at Rockhall Harbor was 5 feet, with an average range of tide of 1.1 feet. With an appropriation of $16,000, made June 3, 1896 (the first for this work), a project was carried out in 1897–98 for dredging a cut 80 feet wide and 10 feet deep at mean low water from the 10-foot curve in Swan Creek Inlet to the 10-foot depth in Chesapeake Bay, and a channel 100 feet wide and 10 feet deep from that depth in Swan Creek Inlet to the old pier at Rockhall. A turning basin, embracing the old and new piers, was also dredged.

In accordance with the river and harbor act of March 3, 1899, an examination was made of Rockhall Harbor and the inner harbor at Rockhall, report on which is printed in the Annual Report of the Chief of Engineers for 1900, pages 1670–1672. The project then proposed is dredging a channel 12 feet deep and 150 feet wide from Chesapeake Bay to Swan Creek Inlet, across Swan Point bar, and 12 feet deep and 150 feet wide from Swan Creek Inlet to the wharf at Rockhall, at a cost estimated in 1899 to be $43,065 and $9,208 every two years for maintenance.

The river and harbor act of June 13, 1902, adopted this project, which is the existing one. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $14,383.97 was allotted for this work.

Work under this allotment was completed during the present fiscal year, and resulted in completing the channel from the 12-foot contour in Swan Creek Inlet to the wharf at Rockhall, the turning basin to project dimensions, and in giving an 8-foot channel 70 feet wide for a distance of 2,240 feet across Swan Point bar. The unit price of dredging has exceeded that assumed in the original estimate. The estimated cost of project was increased May 13, 1907, to $60,386.81.

The amount expended on this improvement to June 30, 1909, is $55,713.72, of which $16,600 was on a previous project and $537.54 for maintenance, consisting in the removal of a shoal in the inner harbor.

About two-thirds of the project has been completed. It is proposed to apply the funds asked for to completing the project.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel across Swan Point bar is about 5 feet and in the inner harbor 12 feet, to which point the improvement is navigable in fact. The harbor is a bay making in from Chesapeake Bay and is navigable in fact to Rockhall pier, which is about one-fourth mile above the mouth of Rockhall Harbor.

Two steamers and 65 sailing vessels and barges are reported as plying in the harbor, the commerce being valued at $1,678,870. The tonnage for the fiscal year 1909 was 17,703, consisting of lumber, coal, canned goods, poultry, and live stock, fish, oysters, and general merchandise.

It is stated that the improvement has had no appreciable effect on freight rates.

July 1, 1908, balance unexpended	$14,239.59
June 30, 1909, amount expended during fiscal year, for works of improvement	14,139.99
July 1, 1909, balance unexpended	99.60
Amount (estimated) required for completion of existing project	21,711.03
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	([a])

(*b*) *Queenstown Harbor.*—Before 1871 the controlling depth in this harbor was 6 feet, with a range of tide of about 2 feet. Between that year and 1880 it was improved under a project dated January 2, 1871, and a channel 100 feet wide at bottom and 8 feet deep at mean low water was made. In 1897, with $5,000 appropriated for continuing the improvement, a channel was dredged to 8½ feet at mean low water and 100 feet wide from Chester River to the inner harbor, to which point the bay is navigable in fact, and in 1900 a shoal extending from a point 138 feet above the lower light down for a distance of 950 feet was dredged to a depth of 8 feet and a width of 80 feet.

The river and harbor act of June 13, 1902, provided that the improvement should be made in accordance with the report submitted and printed in the Annual Report of the Chief of Engineers for 1900, pages 1673–1676. The project therein submitted contemplates increasing the dimensions of the channel so as to make them 10 feet deep and 200 feet wide, at an estimated cost of $23,100.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $4,975.70 was allotted for this work.

A contract for expenditure of funds was entered into and dredging completed in the winter of 1907, advancing the project to that extent. Funds asked for are intended to continue the project and for maintenance. Owing to the insufficient appropriations, the work has been prolonged and the cost of maintenance is added to the original estimate. The unit price of dredging has exceeded that in the original estimate. The estimated cost of project was therefore increased May 13, 1907, to $25,886.35.

The amount expended on this improvement to June 30, 1909, is $40,572.39, of which $20,269.14 was on the existing project, and $1,303.25 for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract work and proportion of office expenses. About four-fifths of the project has been completed.

---

[a] See consolidated money statement on page 243.

The entire channel has been dredged to a depth of 10 feet, but the maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement was 9 feet.

Six steamers and 175 sailing vessels and barges are reported to ply in the harbor. The tonnage of the harbor is reported to be as follows: 1900, 12,373; 1901, 11,328; 1902, 18,769; 1903 (only partial statistics could be obtained), 3,889; 1904, 19,144; 1905, 19,421; 1906, 19,808; 1907, 20,202; 1908, 22,220, valued at $1,169,716, consisting of lumber, coal, agricultural products, canned goods, poultry and live stock, fish, oysters, and general merchandise.

The harbor is a bay making from the Chester River and is navigable in fact to Queenstown, which is about one-half mile above mouth of harbor. The improvement has made no perceptible difference in freight rates.

July 1, 1908, balance unexpended	$721.15
June 30, 1909, amount expended during fiscal year, for works of improvement	711.34
July 1, 1909, balance unexpended	9.81
Amount (estimated) required for completion of existing project	5,607.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(c) *Claiborne Harbor.*—Claiborne is on the eastern shore of Chesapeake Bay, about 6 miles east from Bloody Point light-house. No improvement there had ever been made by the United States previous to the existing project. The controlling depth was 9 feet at mean low water, with a mean range of tide of about 2 feet.

The act of June 13, 1902, adopted the existing project, which provides for dredging a channel 12 feet deep at mean low water and 300 feet wide from the 12-foot contour in Eastern Bay to the railroad pier in the harbor, a distance of about 1,900 feet, and thence shoreward along the south side of the pier to a width of 195 feet for a length of 500 feet, at an estimated cost of $17,490, and a further sum of $2,500 for an extension of the existing jetty should it be found necessary.

The jetty extension is now deemed necessary to preserve the north side of the channel to project dimensions from the current from Eastern Bay around Tilghmans Point, which, passing over the sand flats, carries material into the dredged channel at the outer end of the present jetty. The scour has been considerable in the last few years and has eroded Tilghmans Point, which formerly acted as a deflector, to such an extent as to render jetty extension necessary for the maintenance of the channel.

A 12-foot depth at mean low water was dredged with variable widths in the fiscal year ending June 30, 1904. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $3,440.24 was allotted for this work. A contract for expenditure of funds was entered into and dredging finished in the spring of 1908, which resulted in restoring the channel to dimensions left in 1905. Funds asked for are for completion of project. About three-fifths of the project has been completed.

---

[a] See consolidated money statement on page 243.

There was allotted during the fiscal year the sum of $12,000 from appropriation for emergencies in river and harbor works, act March 3, 1909, to be applied to restoring the project channel which has seriously deteriorated, and contract is about to be entered into.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel is 8 feet. The amount expended to June 30, 1909, is $20,307.29, of which $4,996.80 was for maintenance.

The money expended during the fiscal year was for payment of retained percentages on contract work and proportion of office expenses.

Owing to insufficient appropriations the work has been prolonged and the cost of maintenance is added to the original estimate. The unit price of dredging has exceeded that in the original estimate. The estimated cost of project was therefore increased May 13, 1907, to $27,408.30.

Claiborne is at the head of navigation in Claiborne Harbor, and is the western terminus of the Baltimore, Chesapeake and Atlantic Railway. It is about one-half mile from the mouth of the harbor.

Three steamers and 71 sailing vessels and barges are reported to ply in the harbor.

The tonnage of the harbor is reported to be as follows: 1903, 89,549; 1904, 90,435; 1905, 93,603; 1906, 91,957; 1907, 93,794; 1908, 103,173, valued at $7,975,500, consisting of agricultural products, canned goods, poultry and live stock, lumber, coal, and general merchandise. The improvement has made no appreciable difference in freight rates. Reference to a survey is to be found on page 185 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended		$310.49
Amount alloted from appropriation by river and harbor act approved March 3, 1909		12,000.00
		12,310.49
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$310.49	
For maintenance of improvement	3.70	
		314.19
July 1, 1909, balance unexpended		11,996.30
Amount (estimated) required for completion of existing project		14,597.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

---

[a] See consolidated money statement on page 243.

(*d*) *Cambridge Harbor.*—This harbor is on the eastern side of the Choptank River, about 20 miles above its mouth, and Cambridge is the head of navigation at the mouth of the harbor. In 1870, before operations were commenced, there was a controlling depth of 4 feet, with a mean range of tide of about 1.7 feet. The improvement of the harbor was commenced in 1871 with a project submitted in March of that year for an entrance way of 100 feet in width and to provide sufficient harbor accommodations of a depth of 10 feet at mean low water. The estimated cost was $36,000. The sum of $10,000 was appropriated March 3, 1871, and work begun. On this and succeeding projects $50,237 was expended to June 30, 1896, resulting in a channel 150 feet wide and 12 feet deep at mean low water from that depth in the Choptank River to the railroad wharf, a distance of nearly a mile. The inner harbor below the bridge had been dredged over its whole irregular area to a depth of 10 feet, and the part of the harbor above the bridge for a distance of 750 feet had been dredged to a depth of 8 feet and a width of 215 feet. A survey was made in 1896 (printed in Annual Report of the Chief of Engineers for 1897, p. 1297), and the improvements then recommended were for a 12-foot low-water channel 150 feet wide from the 12-foot curve in the Choptank River to a point 500 feet outside the Baltimore, Chesapeake and Atlantic Railway Company's steamboat wharf, and from this point gradually widening to the harbor line at the wharf; from the steamboat wharf to Mill wharf to increase the width an average of 200 feet, with a depth of 8 feet, making an anchorage basin; increasing the width of the lower harbor 40 feet on the north side and widening the upper harbor an average of 360 feet along the channel already dredged to a depth of 8 feet. The estimated cost of the project was $8,120. It is the existing one.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $1,531.63 was allotted for this work. A contract for expenditure of funds was entered into and dredging under it finished in the summer of 1907, resulting in advancing part of the 8-foot project and removing some shoals in the 12-foot part of the project.

The amount expended on this improvement to June 30, 1909, is $57,846.78, of which $50,237 was on previous projects and $244.76 for maintenance.

Owing to insufficient appropriations the work has been prolonged and the cost of maintenance is added to the original estimate. The estimate of cost of project was increased May 13, 1907, to $13,858.25. The project is about five-eighths completed. All funds are intended to be applied to continuation and maintenance of the project. The money expended during the fiscal year was for payment of retained percentages on contract work and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel below the bridge was 10 feet, and about 8 feet above as far as the channel has been dredged.

Six steamers and 152 sailing vessels and barges are reported to ply in the harbor, the commerce being valued at $2,227,659. The tonnage of the river is reported to be as follows: For the year ended May 1, 1909, 66,703, consisting of grain, lumber, coal, fertilizer, canned goods, fish and oysters, and agricultural products. The improvement has made no appreciable difference in freight rates.

July 1, 1908, balance unexpended	$189.11
June 30, 1909, amount expended during fiscal year, for works of improvement.	146.46
July 1, 1909, balance unexpended	42.65
Amount (estimated) required for completion of existing project	6,450.58
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	([a])

(*e*) *Chester River, Maryland, from Crumpton to Jones Landing.*—Before operations were undertaken on this part of the river vessels at low tide drawing 6 feet of water could reach Crumpton, 33 miles above the mouth, and from that point to Jones Landing (to which point the stream is navigable in fact), 6½ miles, the controlling depth was 3 feet, with a mean range of tide of 2.4 feet. The project for improvement, adopted by the river and harbor act of September 19, 1890, is for a 6-foot low-water channel from Crumpton to Jones Landing, at an estimated cost of $12,750, increased in 1896 to $14,250, and still later to $19,562.50. There has been but one project for this section of the river.

Before the adoption of the present project there had been appropriated for this river $41,000, of which $2,958.54 was carried to the surplus fund on June 30, 1909.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on the east shore of Chesapeake Bay, and $2,417.36 was allotted for this work. A contract for expenditure of funds for maintenance was entered into and dredging for maintenance under it finished in the winter, restoring project dimensions from Crumpton to Ford's wharf.

The sum of $5,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

The amount expended on this improvement to June 30, 1909, is $23,264.36, of which $5,604.88 was for maintenance. The project is completed.

The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the river was 4 feet.

Six steamers and 175 sailing vessels and barges are reported to ply in the river, the commerce being valued at $3,917,210. The tonnage of the river is reported to be as follows: 1906, 48,199; 1907, 49,162; 1908, 54,078, consisting of lumber, poultry and live stock, fish and oysters, canned goods, agricultural products, and general merchandise. The improvement has made no appreciable difference in freight rates.

It is proposed to apply funds asked for to removing shoals that have formed in the channel since it was dredged.

---

[a] See consolidated money statement on page 243.

July 1, 1908, balance unexpended	$252.30
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	5,252.30
June 30, 1909, amount expended during fiscal year, for works of improvement.	252.30
July 1, 1909, balance unexpended	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*f*) *Choptank River, Maryland.*—Before improvements were begun in 1879 the depth of water in the channel between Denton and Greensboro varied from 2 to 8 feet, with a mean range of tide of about 2 feet. Navigation, carried on by small sailing vessels, extended to only 3 miles above Denton. Upon the remaining 5 miles to Greensboro, the head of navigation, all freight had to be transported upon scows. Greensboro is about 46 miles above the mouth of the river.

A project for improvement was made in 1880 for an 8-foot low-water channel 75 feet wide, at an estimated cost of $79,000. At the close of the fiscal year 1903 the project channel had been completed, except for a distance of about 1 mile at the upper end, but there has been some shoaling since.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $9,662.55 was allotted for this work. A contract for expenditure of funds was made and dredging under it completed in 1908 and resulted in completing the project except for a distance of about 1,200 feet. About one twenty-fifth of the project remains to be done.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement was 7 feet.

The amount expended on this improvement to June 30, 1909, was $80,502, of which $4,344.69 was for maintenance. The amount expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

Six steamers and 251 sailing vessels and barges are reported as plying in the river, the commerce being valued for the past calendar year at $17,743,390. The tonnage of the river is reported to be as follows: 1903, 208,367; 1904, 210,447; 1905, 212,725; 1906, 208,496; 1907, 212,661; 1908, 233,916, consisting of lumber, coal, canned goods, poultry and live stock, fish and oysters, agricultural products and general merchandise. The improvement has made no appreciable difference in freight rates.

It is proposed to apply the funds asked for to completing the project and maintenance.

---

[a] See consolidated money statement on page 243.

July 1, 1908, balance unexpended	$1,445.28
June 30, 1909, amount expended during fiscal year, for works of improvement	1,399.73
July 1, 1909, balance unexpended	45.55
Amount (estimated) required for completion of existing project	2,797.14
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]

(*g*) *Warwick River, Maryland.*—This river, formerly named Secretary Creek, is in Dorchester County, eastern shore of Maryland, and flows into the Choptank River, one of the largest tributaries of Chesapeake Bay. It is a small tidal basin 2 miles long, with no fresh-water influx at the head, and was originally only 4 feet deep. The average rise of tide is 2 feet. The original project for the stream is dated January 20, 1880.

Before the adoption of the present project about $12,000 had been expended in the improvement of this river—$6,000 by the General Government and the remainder by private parties. The existing project for improvement, based upon a survey in 1891 (printed in Annual Report of the Chief of Engineers for 1891, p. 1219) and adopted by the river and harbor act of July 13, 1892, provides for a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in Choptank River to Secretary Landing, at the head of the river including a turning basin at the latter point, at an estimated cost of $18,600. The project was completed in July, 1903, but shoals formed rapidly.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $3,493.87 was allotted to this work. A contract was entered into and the dredging finished under it in the summer of 1907, restoring the project dimensions from the turning basin to Cedar Point. Funds asked for are intended to be applied to maintenance.

The sum of $3,000 was allotted from the appropriation for preservation and maintenance of river and harbor work, act March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

The amount expended on present project to June 30, 1909, is $21,402.87, of which $5,362.05 was for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses. The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement was 9 feet.

Six steamers and 80 sailing vessels and barges are reported as plying in the river, the commerce being valued at $3,441,826. The tonnage of the river is reported to be as follows: 1903, 65,206; 1904, 65,858; 1905, 66,631; 1906, 60,027; 1907, 61,225; 1908, 67,346, consisting of lumber, canned goods, poultry and live stock, fish and oysters, agricultural products and general merchandise.

The improvement has made no appreciable difference in freight rates.

---

[a] See consolidated money statement on page 243.

July 1, 1908, balance unexpended	$571.05
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	3,571.05
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	571.05
July 1, 1909, balance unexpended	3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a]

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*h*) *Pocomoke River, Maryland.*—This river has been under improvement by the General Government since 1878, the original project being dated November 19, 1878. In 1879 and 1880, $12,500 was expended on work below Snow Hill, chiefly in the rectification of the channel and in giving increased width, the depth being 7 feet at mean low water. In 1888, with an appropriation of $8,000, a cut-off was made through the low neck of land forming four abrupt bends just below Snow Hill. At the close of these operations there was a channel not less than 80 feet wide and 7 feet deep between Snow Hill and Shad Landing, a distance of about 4½ miles.

The existing project adopted by the river and harbor act of June 3, 1896, is based upon a survey made in 1894–95 (printed in Annual Report of the Chief of Engineers for 1895, p. 1167) and is for dredging the channel between Snow Hill and Shad Landing to a depth of 9 feet at mean low water and a width of from 100 to 130 feet, at an estimated cost of $14,000. The mean range of tide is 2½ feet. Snow Hill is the head of navigation on this stream and is about 28 miles above the mouth. With funds provided from 1897 to 1904 the channel was dredged to the project dimensions.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay and $2,298.60 was allotted to this work. A contract for expenditure of funds for maintenance was made and dredging under it finished in June, 1908, removing three shoals.

The sum of $2,500 was allotted from the appropriation for preservation and maintenance of river and harbor works, act March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

To the end of the fiscal year $37,341.60 has been expended for the improvement of this river, of which $20,500 was on previous projects and $2,570.87 for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses. The project is completed and the additional work required is for maintenance.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement was 7 feet.

Three steamers and 88 sailing vessels and barges are reported as plying in the river, the commerce being valued at $4,986,058. The tonnage of the river is reported to be as follows: 1903, 245,568; 1904,

---

[a] See consolidated money statement on page 243.

246,223; 1905, 67,165; 1906, 65,710; 1907, 67,024; 1908, 73,727, consisting of lumber, coal, cord wood, canned goods, poultry and live stock, agricultural products, and general merchandise.

The improvement has made no appreciable difference in freight rates.

July 1, 1908, balance unexpended	$2,219.35
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,500.00
	4,719.35
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,219.35
July 1, 1909, balance unexpended	2,500.00

(i) *La Trappe River, Maryland.*—This stream, formerly known as Dividing Creek, has a length of about 3 miles and is a tributary of Choptank River. The head of navigation is at Trappe Landing. The controlling depth prior to 1893 was 4 feet, with a mean range of tide of 2 feet, but was afterwards increased to 8 feet by dredging, under private subscription. The original project, which is the existing one, was adopted by the river and harbor act of July 13, 1892, and is for a channel 150 feet wide and 11 feet deep at mean low water across the bar at the mouth and for a width of 75 feet and a depth of 8 feet inside the bar as far as Trappe Landing, with a turning basin at the latter point, at an estimated cost of $7,250, subsequently increased to $9,750. The project has been completed and the additional work required is for maintenance.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $2,135.39 was allotted for this work. A contract was made for expenditure of funds for maintenance and dredging under it was finished the last month of 1907, restoring turning basin to project dimensions.

The sum of $3,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

The amount expended to June 30, 1909, is $11,252.89, of which $3,289.02 was for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel was 7 feet. Three steamers and 83 sailing vessels and barges are reported as plying in the river, the commerce being valued at $962,646, consisting of lumber, coal, canned goods, poultry and live stock, agricultural products, and general merchandise.

The tonnage of the river is reported to be as follows: 1903, 11,466; 1904, 13,601; 1905, 13,848; 1906, 13,588; 1907, 13,859; 1908, 15,244.

The improvement has made no appreciable difference in freight rates.

July 1, 1908, balance unexpended	$224.20
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	3,224.20
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	224.20
July 1, 1909, balance unexpended	3,000.00

(*j*) *Manokin River, Maryland.*—Before improvements were commenced in 1891 the depth of water at the mouth of the river at the so-called "Mud flats" was between 1 and 2 feet at low tide. These flats are about 2½ miles wide and make navigation impossible except at high water, thereby rendering the upper part of the river, which has a very fair depth and width, almost useless for extensive shipping purposes. The average rise of tide at the flats is 2.6 feet. Princess Anne is the head of navigation and is about 12 miles above the mouth of the river.

The project was adopted by the river and harbor act of September 19, 1890, and is based upon a survey made in August and September, 1889. (Report printed in Annual Report of the Chief of Engineers for 1890, p. 961.) It provides for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharps Point, a distance of about 2½ miles and embracing the section called the "Mud flats," at an estimated cost of $30,000.

From 1891 to 1900 dredging on the whole project was done at various times as funds became available. At the close of these operations there was a channel 6 feet deep from Sharps Point to about a mile above Dashiells Creek and a slightly less depth to the steamboat wharf above, and at the mouth soundings taken over the area formerly dredged showed a range of depth from 4.5 to 7.3 feet. No work was done afterwards until that of the autumn of 1905, which consisted in removing shoals that had formed, and resulted in a controlling depth of but 3 feet.

The creation and maintenance of a channel across the mud flats at the mouth of this river is a work of some difficulty and uncertainty under the method adopted, which was originally considered as tentative only and the best that the commercial importance of the project would justify. Funds have not been available for adequate maintenance and the channel has deteriorated rapidly. The estimate of cost of project was increased May 13, 1907, to $42,103.99. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $9,160.69 was allotted for this work. A contract for expenditure of funds was made and dredging under it completed in June, 1908.

The amount expended on the improvement to June 30, 1909, is $36,407.69, and $2,000 additional was expended on the upper river, which is not included in the existing project. The amount expended for maintenance was $8,511.13. About two-thirds of the project is completed. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel at the mouth was 3½ feet.

It was impracticable to procure commercial statistics. The improvement had made no appreciable difference in freight rates.

It is proposed to apply the funds asked for toward completing the project.

July 1, 1908, balance unexpended	$5,377.92
June 30, 1909, amount expended during fiscal year for works of improvement	5,352.42
July 1, 1909, balance unexpended	25.50
Amount (estimated) required for completion of existing project	14,181.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(*k*) *Tyaskin Creek.*—This stream is also known as Wetipquin Creek, or River. It is a small tributary of Nanticoke River, having a length of about 5 miles. The controlling depth in the creek was 8 feet, but on the bar at the mouth it was but 3½ feet at mean low water, with an average rise and fall of the tide of 3 feet. A survey was made in 1899 (report printed in Annual Report of the Chief of Engineers for 1900, p. 1681). The existing project, which is the original one, was adopted by the river and harbor act of June 13, 1902, and is for a channel 9 feet deep at mean low water, with a width of 120 feet, at an estimated cost of $13,200. Under a survey made in January, 1906, the estimate of cost of completion of this project, with a suitable turning basin added, is $6,462.39.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on the east shore of Chesapeake Bay, and $6,500 was allotted to complete this work. A contract was made for completion and dredging was finished, as far as funds permitted, in the spring of 1908. The channel was completed to the project depth and width, but owing to shoaling since the survey and estimate were made in January, 1906, the turning basin was left at a controlling depth of 7 feet at mean low water, which is ample for present needs. Funds asked for are intended to be applied to completing turning basin and maintenance of project.

The amount expended to June 30, 1909, is $16,556.32, of which $2,443.91 was for maintenance and $3,954.41 on project as modified by estimate of January, 1906. The project is about two-thirds completed. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the improvement was 8 feet and the turning basin 7 feet.

Three steamers and 36 sailing vessels and barges are reported as plying in the creek, the commerce being valued at $78,710. The tonnage of the creek is reported to be as follows: 1903, 784; 1904, 796; 1905, 856; 1906, 945; 1907, 967; 1908, 1,064, consisting of lumber, canned goods, poultry and live stock, agricultural products, and general merchandise.

---

[a] See consolidated money statement on page 243.

The improvement has made no appreciable difference in freight rates.

Reference to reports on examination and survey required by the river and harbor act of March 3, 1905, will be found on page 214 of the Report of the Chief of Engineers for 1906.

July 1, 1908, balance unexpended	$909.24
June 30, 1909, amount expended during fiscal year, for works of improvement	807.56
July 1, 1909, balance unexpended	101.68
Amount (estimated) required for completion of existing project	2,406.30
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

CONSOLIDATED.

July 1, 1908, balance unexpended		$26,459.68
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,500.00
		51,959.68
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$23,120.29	
For maintenance of improvement	3,018.30	
		26,138.59
July 1,1909, balance unexpended		25,821.09
Amount (estimated) required for completion of existing project		67,752.19
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		80,000.00

(See Appendix J 6.)

7. *Nanticoke River, Delaware and Maryland.*—This river is a tidal stream, its headwaters consisting of numerous branches rising mainly in the northern section of Sussex County, Del. The river flows in a southwesterly direction into Tangier Sound, Chesapeake Bay, and the interests for the improvement of the river center at Seaford, the head of navigation, 36 miles from the mouth, where the range of tide is about 3.4 feet.

The river and harbor act of August 18, 1894, appropriated $5,000 for improving Broad Creek River, Delaware, a branch of Nanticoke River, and provided that as much of it as might be necessary should be used for the removal of the bar extending from the railroad bridge at Seaford toward the mouth of Nanticoke River. With this appropriation the channel was dredged where necessary to a width of 100 feet and a depth of 9 feet at mean low water from the south side of the railroad bridge at Seaford to a point 8,000 feet below. A previous appropriation for the Nanticoke River in 1886 was, in accordance with the terms of the law, applied to Broad Creek River up to Laurel.

---

[a] See consolidated money statement on this page.

The existing project for the improvement of the Nanticoke River is based upon a survey made in 1895 (printed in Annual Report of the Chief of Engineers for 1895, pp. 1165 to 1167) and is for a channel 9 feet deep at mean low water and 100 feet wide, the width to be increased to about 150 feet at sharp turns of the channel, the improvements to be extended to within 100 feet of the county bridge, where the proposed channel is to widen out fan-shaped at an estimated cost of $13,000. The project is completed and the additional work required is for maintenance.

A contract for expenditure of funds for maintenance was made and dredging under it finished in May, 1908.

The sum of $2,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act of March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

The amount expended to June 30, 1909, was $15,000, of which $5,000 was on a previous project and $4,429.26 for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel was 8½ feet.

Three steamers and 105 sailing vessels and barges are reported as plying in the river, the commerce being valued at $7,540,155. The tonnage of the river is reported to be as follows: 1903, 119,038; 1904, 120,229; 1905, 121,769; 1906, 119,348; 1907, 121,733, and for calendar year ended May 1, 1909, 132,842, consisting of lumber, coal, canned goods, poultry and live stock, fish and oysters, agricultural products, and general merchandise.

The improvement has made no appreciable difference in freight rates.

July 1, 1908, balance unexpended	$302.99
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	2,302.99
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	302.99
July 1, 1909, balance unexpended	2,000.00

(See Appendix J 7.)

8. *Broad Creek River, Delaware.*—This is a tributary of the Nanticoke River, and in 1881 the controlling depth was 1½ feet, with a mean range of tide of 3 feet. In 1889 a channel 6 feet deep at mean low water and 50 feet wide had been dredged under project dated February 4, 1880, from Bethel to Laurel, the head of navigation, about 7½ miles from the mouth of the river, at a cost of $35,000. The existing project, adopted by the river and harbor act of July 13, 1892, is for a channel 70 feet wide and 8 feet deep at mean low water between Bethel and Laurel, at an estimated cost of $15,000. The projected channel was dredged except for a short distance at the upper end, where it was reduced to 60 feet in width to secure the stability of some wharves. Contract was entered into and dredging under it finished in June of 1908, removing shoals above and for a

distance of about 1,000 feet below the railroad bridge at Laurel. The appropriation requested is intended to be applied to maintenance.

The amount expended to June 30, 1909, is $16,500, of which $1,500 was for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract, and proportion of office expenses. The project is completed and the additional work required is for maintenance.

The sum of $2,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act March 3, 1909, for maintenance, and the contract for the work is about to be entered into.

The maximum draft that could be carried June 30, 1909, at mean low water, over the shoalest part of the channel is reported to be 7 feet.

One steamer and 34 sailing vessels, power boats, and barges are reported as plying in the river, the commerce being valued at $444,512. The tonnage of the river for the year ending May 1, 1909, is reported to be 28,480, consisting of fertilizer, lumber, canned goods, flour and feed, shooks and crates, agricultural products, and general merchandise.

The improvement is reported to have made a reduction of 25 per cent in freight rates.

July 1, 1908, balance unexpended	$1,400.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	3,400.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,400.00
July 1, 1909, balance unexpended	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 8.)

9. *Wicomico River, Maryland.*—The portion of the river at and just below Salisbury, which is the head of navigation and 23 miles from the mouth, has been under improvement by the United States since 1872, under project dated April 15, 1871. The average rise and fall of tide is 3 feet. At that time the navigable channel, with a minimum depth of 8 feet at low water, extended to a point within 2 miles of Salisbury. The extreme upper portion, as far as the milldam in the heart of the town, was quite shoal, and has an average depth of only 18 inches at low tide. Between 1872 and 1885 a channel 75 to nearly 100 feet wide and 7 feet deep at low water was dredged from deep water below to the drawbridge in the town, at a cost to the Government of about $50,000.

The existing project, based upon a survey of the river made in 1889 (printed in Annual Report of the Chief of Engineers for 1890, pp. 947–950), provides for a channel 9 feet deep at mean low water, from that depth below to the drawbridge at Salisbury, the width to be from 100 to 150 feet, at an estimated cost of $23,200. At the time this project was adopted there existed a 7-foot low-water channel from 75 to 100 feet wide to Salisbury. The project has been completed and the additional work required is for maintenance.

Contract for maintenance was entered into and dredging under it finished in the spring of 1908, restoring dimensions of the upper part of the channel.

The amount expended to June 30, 1909, is $87,516, of which $50,000 was on previous projects and $7,442.24 for maintenance. The money expended during the fiscal year was for payment of retained percentages on contract and proportion of office expenses.

The sum of $5,000 was allotted from the appropriation for preservation and maintenance of river and harbor works, act of March 3, 1909, for maintenance, and a contract for the work is about to be entered into.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement was 8 feet.

Two steamers and 82 sailing vessels and barges are reported as plying in the river, the commerce being valued at $15,449,526. The tonnage of the river is reported to be as follows: 1903, 197,306; 1904, 199,279; 1905, 202,510; 1906, 198,451; 1907, 202,416; 1908, 222,657, consisting of lumber, coal, canned goods, poultry and live stock, fish and oysters, agricultural products, and general merchandise. The improvement has made no appreciable difference in freight rates.

Reference to reports on examination and survey of the river required by the river and harbor act of March 3, 1905, will be found on page 215 of the Report of the Chief of Engineers for 1906.

It is proposed to apply the appropriation asked for in restoring the channel to project dimensions below Williams's wharf.

July 1, 1908, balance unexpended	$244.58
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	5,244.58
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	244.58
July 1, 1909, balance unexpended	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 9.)

10. Crisfield Harbor, Maryland.—This harbor is situated at Somers Cove, Little Annemessex River, which at this point is an estuary of Tangier Sound, on the east side of Chesapeake Bay. It is the principal port of the collection district of eastern Maryland. Crisfield is the head of navigation of the harbor and is 1 mile from its mouth. The length of the navigable portion of the harbor is 1¼ miles. Originally the harbor had a controlling depth of 8½ feet at mean low water for a width of 400 feet, with a mean rise and fall of tide of 2.6 feet, but this was not deemed adequate for the commerce of the port. The original project adopted by the river and harbor act of March 3, 1875, was for a channel 266 feet wide and 12 feet deep at mean low water from above the railroad wharf to a point known as the second angle, opposite Somers Cove light, and from that point to deep water below a channel of the same depth 425 feet wide, and in addition a basin on both the north and south sides of the railroad wharf 12 feet deep, at an estimated cost of $37,317.50. The work was completed May, 1876.

The act of March 3, 1905, authorized a survey, which was made in December, 1905, the report thereon being printed in House Document No. 783, Fifty-ninth Congress, first session. The existing project, adopted by the river and harbor act of March 2, 1907, is to restore the channel formerly dredged and to restore and widen the anchorage basin, at an estimated cost of $37,706.62, and an annual cost for maintenance of $800. The estimated cost of the project was increased April 17, 1909, to $47,762. The river and harbor act of March 2, 1907, made an appropriation of $37,707. A contract was entered into and work under it completed in June, 1909. The project is about three-fourths finished. To June 30, 1909, $35,254.52 has been expended on existing project.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the channel under improvement was 12 feet. Funds asked for will be applied to completing the project.

Eight steamers and 536 sailing vessels and barges are reported as plying in the harbor, the commerce being valued at $8,221,918. The tonnage of the harbor is reported to be as follows: 1906, 30,265; 1907, 30,738; 1908, 102,982, consisting of lumber, canned goods, poultry and live stock, fish and oysters, agricultural products, and general merchandise. The improvement has made no appreciable difference in freight rates.

A report on a survey of this harbor is to be found beginning on page 105, Part 2, Annual Report of the Chief of Engineers for 1875.

July 1, 1908, balance unexpended	$37,660.57
June 30, 1909, amount expended during fiscal year, for works of improvement	35,208.09
July 1, 1909, balance unexpended	2,452.48
July 1, 1909, outstanding liabilities	154.00
July 1, 1909, balance available	2,298.48
Amount (estimated) required for completion of existing project	10,055.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	10,055.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year the following wrecks were removed: Schooner *J. E. Watkins* from Chesapeake Bay, Maryland, near Sevenfoot Knoll, at a cost of $220, and the schooner *Alethea* from Rock Creek, Maryland, at a cost of $400. The total amount expended was $620.

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated May 9, 1907, and January 7, 1908, on preliminary examination and survey, respectively, of *Tuckahoe River, Maryland, with a view to obtaining an increased depth from Wymans wharf to the town of Hillsboro,* required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1160, Sixtieth Congress, second session. A plan for improvement at an estimated cost of approximately $15,600 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE WASHINGTON, DISTRICT OF COLUMBIA, DISTRICT.

This district was in the temporary charge of Capt. E. J. Dent, Corps of Engineers, to July 18, 1908; in the charge of Maj. Spencer Cosby, Corps of Engineers, from July 18 to December 22, 1908, having under his immediate orders Capt. E. J. Dent and First Lieut. W. T. Hannum, Corps of Engineers; in the charge of Maj. J. J. Morrow, Corps of Engineers, since the latter date, having under his immediate orders Lieutenant Hannum. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. Potomac River at Washington, D. C.—Before improvement the Virginia channel was obstructed by two bars. The upper bar extended upstream from Long Bridge to about one-half mile below Easby Point, and the ruling depth on this bar was 8 feet. The lower bar was near Giesboro Point and had a ruling depth of 14 feet. The ruling depth in the Washington channel was 10 feet. Georgetown Harbor was obstructed by several dangerous rocks. The flats, which extended to the edge of the Virginia channel, were largely bare at low water and were an active agent in spreading malarial and other diseases. In 1849, $1,500 was appropriated for a survey of the river. Of this sum $1,208.61 was expended and the balance of $291.39 covered into the surplus fund of the Treasury.

Between June 11, 1870, and March 3, 1881, the sum of $290,000 was appropriated by Congress for the improvement of the harbors of Washington and Georgetown. The project under which this last-mentioned sum was expended is not definitely stated, although it is understood that it provided for dredging channels 16 feet deep and 200 feet wide through the Georgetown and Washington channels, and for the removal of the most dangerous rocks obstructing navigation in the harbor of Georgetown to a depth of 20 feet.

The existing project for the improvement was adopted August 2, 1882, and has for its object the improvement of the navigation of the river by widening and deepening its channels, the reclamation of the flats by depositing on them the material dredged from the channels, the freeing of the Washington channel of sewage, and the establishment of harbor lines. To effect these, the project provided "that the channel depths * * * should be sufficient to accommodate the largest draft vessels that can be brought up to Arsenal Point" (the projected depth was not stated in feet, but by the above-imposed condition was at that time limited to 20 feet at low tide, whereas the ruling depth in the Potomac River below Washington has now been increased by dredging to 24 feet at low tide), that the flats be reclaimed to a height of 3 feet above the flood plane of 1877 (which, although the highest recorded freshet at that time, was exceeded by about 3 feet by the flood of 1889), and for a tidal reservoir to be provided with automatic inlet and outlet gates. A training dike on the Virginia shore extending downstream from Analostan Island was added to the project in 1890. The project also provided for the rebuilding of Long Bridge and for the interception of all sewage discharged into the Washington channel, but neither of these works was included in the estimated cost of the improvement, which was $2,716,365. The estimate as revised in 1897 is $2,953,020.

The amount expended on the work of the existing project to June 30, 1909, was $2,758,564.56, of which $475,356.81 has been applied to maintenance since March 3, 1899. The following sums have been obtained from other sources than appropriations: Received from sale of blueprints, 50 cents; of condemned property, $212.83; total, $213.33.

The expenditure resulted in the dredging of a channel 20 feet deep and 550 feet wide through the bar above Long Bridge, in increasing the width of the natural channel just below Long Bridge by 50 to 500 feet, and in deepening it to 20 feet; in dredging a channel 350 feet wide and 20 feet deep through the bar in the Virginia channel near Giesboro Point; in dredging the Washington channel to a width of 400 feet and a depth of 20 feet; in dredging between this navigation channel and the wall of the adjacent reclaimed area to a depth of 12 feet; in dredging at the junction of the Washington and Virginia channels; in dredging the tidal reservoir (111 acres) to a depth of about 8 feet, and restoring this depth to its area; in several times redredging cuts 20 feet deep through bars which had re-formed by freshet action in the Virginia and Washington channels; in the completion of and repairs to the reservoir outlet; in the construction of about 98 per cent of the combined inlet gates and bridge for the tidal reservoir; in the construction of 35,289 linear feet of sea wall, of which 8,876 linear feet has been taken down and relaid; and in the building of 5,965 linear feet of training dike, containing about 21,218 cubic yards of stone.

The area of land reclaimed by these operations is 628 acres (or, including reservoir, 739 acres), which, by act of March 3, 1897, was declared to be a public park, under the name of "Potomac Park."

The amount of material dredged, deposited on the park, and paid for under the various contracts is about 13,893,756 cubic yards. It is estimated that in addition about 3,000,000 cubic yards of material have been dredged under contract and deposited on the park, but not paid for, owing to its having been excavated outside the specified limits.

In additon to the foregoing, a large amount, estimated at 915,000 cubic yards, of clean desirable earth has been deposited upon the park by private parties working under permits.

The entire project is now about 90 per cent completed.

The work of maintenance during the year consisted in finishing the dredging in the Virginia channel and tidal reservoir, in making additions and repairs to sea wall, in care of property, and in repairs to plant, etc., and in general maintenance of the improvement.

The work on the project during the year consisted in continuing the building of the combined inlet gates and bridge for the reservoir.

The project for the improvement of the Potomac River at Washington provides for a flushing basin, with automatic gates at the inlet and outlet, so arranged that at each oscillation of the tide the basin or tidal reservoir will be filled during flood tide from the Virginia channel and emptied to the level of low water during the ebb tide into the Washington channel.

In order to provide for a highway connecting the park drives on each side of the inlet to the tidal reservoir, an appropriation of $25,000 was made by act of Congress approved May 27, 1908 (sundry civil appropriation act), to defray the additional expense involved in widening the proposed inlet gates and constructing a road across them.

The plans provide for a structure with automatic gates to close during the ebb and open during the flood tide, with curtain gates to be closed when the Potomac River is heavily charged with sediment, with a lock for the passage of small water craft, and with a park highway over the top. The structure will rest upon a pile foundation and will be of concrete or reenforced concrete throughout. A consulting architect has been employed to design the ornamental features, and a consulting mechanical engineer to assist in the design of the gates and operating machinery.

During the fiscal year 1908 preliminary surveys and current observations were made, general plans were prepared and approved by the Chief of Engineers, nearly all of the necessary construction plant was repaired and erected, the entire foundation was dredged, and about one-third of the bearing piles were driven.

During the present fiscal year the remaining foundation piles were driven, the foundation surrounded by a wooden sheet-pile cofferdam, and concrete piers and superstructure carried up to its present condition. Excluding the installation of the automatic curtain and lock gates, the bridge is estimated to be 98 per cent completed.

The furnishing and emplacing of piles was done under a formal contract, and a contract is in force for the furnishing and installation of lock and curtain gates.

All other construction has been done by day labor under the direction of this office, materials being purchased in accordance with regulations.

In addition to $25,000 appropriated by the sundry civil act, approved May 27, 1908, there has been expended from the appropriation for improving Potomac River, approved March 2, 1907, for the construction of the combined bridge and inlet gates $81,382.77, which includes the cost of the relocation and construction of 380 feet of sea wall. Two hundred and ninety additional feet of sea wall formerly laid up dry were reconstructed and laid up in mortar.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the Washington channel was 21 feet. For the Virginia channel it was 18 feet. The mean range of tide is about 3 feet.

The Potomac River is navigable to the foot of Little Falls, 3½ miles above Georgetown, but the Aqueduct Bridge, which crosses the river at Georgetown, 113 miles above the mouth of the river, has no draw and limits the navigation of large steamers and masted vessels.

The principal articles of commerce are sand and gravel, coal, lumber, ice, cord wood, stone, oils, oysters, bricks, coke, and general merchandise. The receipts and shipments during 1908 amounted to about 760,737 tons and were estimated to be worth about $7,843,130.

The benefits to navigation from the improvement made have been marked. Vessels of much deeper draft than those formerly used are now engaged in this trade, and it is understood that freight rates have been materially reduced.

It is proposed to apply the funds on hand and the additional appropriation recommended toward completion of the tidal gates, reconstruction of about 10,000 linear feet of damaged sea wall, dredging in the Washington channel, and prosecution of the project.

The additional work proposed is for the purpose of extension of benefits and for the maintenance of the improvement in a serviceable condition.

Maps of the locality may be found in each Annual Report of the Chief of Engineers since 1877, with the exception of those for 1879, 1882, 1893, 1905, 1906, 1907, and 1908.

Reference to the report on the examination and survey of Potomac River at Washington, D. C., will be found on page 194 of the Annual Report of the Chief of Engineers for 1904.

IMPROVING POTOMAC RIVER.

July 1, 1908, balance unexpended		$192,970.99
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,000.00
Received from sale of condemned property		123.80
		218,094.79
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$67,589.65	
For maintenance of improvement	91,856.37	
		159,446.02
July 1, 1909, balance unexpended		58,648.77
July 1, 1909, outstanding liabilities		5,353.38
July 1, 1909, balance available		53,295.39
July 1, 1909, amount covered by uncompleted contracts		13,924.27
Amount (estimated) required for completion of existing project		611,376.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		180,000.00

TIDAL GATES, POTOMAC PARK.

July 1, 1908, balance unexpended	$25,000.00
June 30, 1909, amount expended during fiscal year, for works of improvement	25,000.00

(See Appendix K 1.)

2. Potomac River below Washington, D. C.—The Potomac River below Washington, D. C., is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

Prior to improvement 24-foot navigation was obstructed by seven shoals, over which the depth ranged from 19½ to 23 feet at low tide. Several of these shoals were long and formed serious obstructions to navigation by deep-draft vessels.

The present, which is also the original, project for this improvement was adopted March 3, 1899. It provides for the improvement of the waterway by dredging channels 24 feet deep and 200 feet wide through all obstructions to 24-foot navigation below Washington, D. C., at an estimated cost of $176,000.

The amount expended to June 30, 1909, was $185,000, of which about $31,164 was applied to maintenance.

As a result of this expenditure, channels 24 feet deep and at least 200 feet wide have been dredged through all the shoals, and 1,484,362 cubic yards of material has been excavated.

No work was done during the fiscal year ended June 30, 1909.

The maximum draft that could be carried on June 30, 1909, at mean low water over the shoalest part of the locality under improvement was 24 feet. The mean range of tide varies from about 1.6 feet at the lower shoals to about 2.8 feet at the upper. Georgetown, 113 miles above the mouth of Potomac River, is the head of navigation for large vessels.

The principal articles of commerce are sand and gravel, coal, lumber, ice, oils, naval ordnance and supplies, cord wood, brick clay, stone, fertilizer, oysters, bricks, phosphate rock, coke, paving blocks, railroad ties, asphalt, potash salt, and general merchandise. The receipts and shipments during 1908 amounted to about 1,442,900 tons, and were estimated to be worth about $21,093,800.

As far as known the work done has had no material effect upon freight rates.

The work provided for under the present project has been completed, and no further appropriation is required therefor.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1890, 1900, 1902, and 1903.

For reference to the reports of the examinations and surveys of Potomac River below Washington, D.C., see page 197 of the Annual Report of the Chief of Engineers for 1904, and House Document No. 859, Sixtieth Congress, first session.

July 1, 1908, balance unexpended	$1,000.00
July 1, 1909, balance unexpended	1,000.00

(See Appendix K 2.)

3. Anacostia River, District of Columbia.—Before improvement the ruling depth from the mouth to the Navy-Yard Bridge was about 18 feet, the channel affording this depth being narrow and tortuous.

An allotment of $20,000 for work in the Anacostia was made from the appropriation of September 19, 1890, for improving Potomac River at Washington. Under this allotment channels 20 feet deep and about 200 feet wide were dredged through shoals near the foot of South Capitol street and opposite Washington Barracks. This dredging was completed in May, 1892, at a cost of $18,536.94, and the balance, $1,463.06, was applied to the present project.

The present project for this stream was adopted June 13, 1902, and provides for the improvement of the portion of Anacostia River below the Navy-Yard Bridge by dredging a channel 20 feet deep for a width of 400 feet, the depth then gradually decreasing to 6 feet at the bulkhead lines, and by depositing the dredged material on the adjacent flats to an average elevation of 7 feet above low tide, the reclaimed area to be surrounded by an earthen embankment to a height of 14 feet above low tide, protected by a masonry sea wall, and provided with suitable drainage through the embankment, all at an estimated cost of $1,218,525.

The amount expended on the existing project to June 30, 1909, was $267,288.15, of which $6,481.10 was applied to maintenance. As a result of this expenditure, a channel 20 feet deep at mean low water and at least 380 feet wide has been secured for a distance of 9,300 feet upstream from the mouth of the Anacostia, i. e., up to upper limits of the navy-yard. The quantity excavated to date amounts to 1,894,320 cubic yards, in addition to which 214,803 cubic yards has been dredged by other departments of the Government and by private parties under permits from, but without cost to, this office.

A riprap wall has been built to a height of 4 feet above mean low water for a distance of 4,900 feet along the left bulkhead line, and 2,900 linear feet of it has been raised to 5 feet. This wall contains 27,367.1 cubic yards of stone, 4,023.1 cubic yards of which was placed during the fiscal year 1909. It will temporarily serve to retain dredged material and will ultimately form the foundation for the projected masonry sea wall.

Seven hundred and ninety-one piles of the old dismantled wharf opposite the navy-yard have been removed.

Incidental to the improvement of the channel about 150 acres of flats have been filled by the deposit of excavated material to an average height of 5 feet above low tide. Harbor lines have been established from the mouth of the river up to Pennsylvania Avenue Bridge.

The work of improvement for the fiscal year 1909 consisted in channel dredging and work incidental thereto, and amounted to $80,302.37. The work of maintenance for the fiscal year consisted in raising the riprap mounds which had settled, and work incidental thereto, and amounted to $6,481.10.

The entire project is now about 25 per cent completed.

The maximum draft that could be carried on June 30, 1909, over the shoalest part of the locality under improvement was 20 feet. The mean range of tide is about 3 feet.

Anacostia River is navigable for large vessels to the Navy-Yard Bridge, for tugs and small vessels to Pennsylvania Avenue Bridge, and for small scows and lighters to Bladensburg, Md., respectively, 2, 2¾, and 8¾ miles above its mouth.

The principal articles of commerce are sand and gravel, naval ordnance and supplies, brick clay, stone, coal, oils, paving blocks, and cord wood. The receipts and shipments during 1908 amounted to about 283,272 tons, and were estimated to be worth about $4,187,866.

The improvement already made has been of benefit to navigation and has resulted in the diversion of considerable traffic from the Washington channel, where conditions were rapidly becoming congested. It is not known that any reduction in freight rates has resulted from the work done.

It is proposed to apply the additional appropriation recommended toward dredging, reclaiming the flats, and completion of the project.

The additional work proposed is for the extension of benefits.

Maps of the locality will be found in the Annual Reports of the Chief of Engineers for 1903, 1904, 1905, 1906, and 1909.

Reference to reports upon examinations and surveys of this river will be found on page 198 of the Annual Report of the Chief of Engineers for 1904.

A report relative to the title to Anacostia flats is printed in House Document No. 194, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended		$97,958.38
Amount alloted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		107,958.38
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$80,302.37	
For maintenance of improvement	6,481.10	
		86,783.47
July 1, 1909, balance unexpended		21,174.91
July 1, 1909, outstanding liabilities		3,936.08
July 1, 1909, balance available		17,238.83
July 1, 1909, amount covered by uncompleted contracts		3,861.34
Amount (estimated) required for completion of existing project		936,543.04
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		230,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix K 3.)

4. Breton Bay, Maryland.—Breton Bay, a tidal estuary of the Potomac River, is about 6¼ miles long and well landlocked. Fifteen feet of water can be carried up the bay for a distance of 4 miles. At the time of the adoption of the project for its improvement, 10-foot navigation in Breton Bay was obstructed by a shoal commencing 5 miles above the mouth and extending to Leonardtown, at the head of the bay. The least channel depth over this shoal was 5 feet at low tide.

The original project for improvement, adopted in 1878 and modified in 1886 and 1890, provided for dredging a channel 150 feet wide and 9 feet deep from the 9-foot contour in Breton Bay to the Leonardtown wharf, with a turning basin for steamboats at the wharf 400 feet wide and 600 feet long, at an estimated cost of $30,000.

From June 18, 1878, to September 19, 1890, nine appropriations, aggregating $37,500, were made. This sum was applied to dredging 214,229 cubic yards of material. The work called for by the original project was completed in 1891.

The present project for this improvement was adopted June 13, 1902, and contemplates the dredging of a channel and turning basin 10 feet deep, the channel to have a minimum width of 200 feet and the turning basin to be 400 feet wide and 600 feet long. The estimated cost of the project is $36,480.

The Board of Engineers for Rivers and Harbors considered this project and recommended, in report dated September 22, 1903, that $6,000 be expended at the earliest practicable date in providing a channel 10 feet deep and wide enough to accommodate the boats now trading in this stream, including a turning basin of ample dimensions at Leonardtown wharf, $4,000 to be applied to new work and $2,000 to maintenance.

It was the opinion of the Board that the expenditure of $4,000 every four years thereafter would be enough to maintain a sufficient turning basin and a channel at least 100 feet wide and wider at the turn, all of a 10-foot depth.

The amount expended under the present project to June 30, 1909, was $12,220.63, of which about $1,797.08 was applied to maintenance. As a result of this expenditure, there has been dredged a channel from Leonardtown wharf to deep water in Breton Bay 150 feet wide, 10 feet deep, and 6,100 feet long, with a turning basin at its head of the same depth, 275 feet wide, and about 500 feet long. The width of the channel is increased to about 220 feet at the turn at Buzzard Point. The project as recommended by the Board of Engineers for Rivers and Harbors is completed except for maintenance.

The total amount of material dredged from the channel under the present project is about 57,000 cubic yards. The work of maintenance done during the fiscal year ending June 30, 1909, consisted of surveys, advertisement, and other incidental expenses to the dredging contemplated for the next fiscal year, amounting to $297.08. The work of improvement consisted of closing up the account for dredging done during the fiscal year 1907, amounting to $485.65.

The maximum draft that could be carried on June 30, 1909, at mean low water, over the shoalest part of the locality under improvement was 10 feet. The mean range of tides is about 1.7 feet. Leonardtown, 6 miles above the mouth of the bay, is the head of navigation.

The principal articles of commerce are oysters, railroad ties, cord wood, lumber, grain, tobacco, farm produce, coal, bricks, fertilizer, and general merchandise. The receipts and shipments during 1908 amounted to about 9,592 tons and were estimated to be worth about $272,533. The number of passengers carried is about 2,000 a year.

The improvement has been of great benefit to shippers in this vicinity, but as far as known there has been no material reduction in freight rates.

No further appropriation is at present required.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887 and 1889.

For reference to reports on examinations and surveys of this locality, see page 199 of the Annual Report of the Chief of Engineers for 1904. For report of Board of Engineers for Rivers and Harbors referred to above, see Annual Report of the Chief of Engineers for 1903, page 1045.

July 1, 1908, balance unexpended		$562.10
Amount appropriated by river and harbor act approved March 3, 1909		4,000.00
		4,562.10
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$485.65	
For maintenance of improvement	297.08	
		782.73
July 1, 1909, balance unexpended		3,779.37

(See Appendix K 4.)

5. York, Mattaponi, and Pamunkey rivers, and Occoquan and Carters creeks, Virginia.—(*a*) *York River.*—Prior to improvement 24 feet could be carried up York River for a distance of 32 miles, to Potopotank bar, over which the ruling depth was 18½ feet. West Point bar, the only other obstruction to navigation, had a least depth of 15½ feet.

The project for this improvement, adopted June 14, 1880, and revised in 1884 and 1887, provides for dredging channels 22 feet deep at mean low water and 400 feet wide through the bars, and for the construction of a dike along the right bank at West Point bar to maintain the channel, at a total estimated cost of $308,800.

The amount expended to June 30, 1909, was $258,685.04, of which $30,761.81 was applied to maintenance subsequent to March 3, 1899. This expenditure has resulted in a dredged channel 105 feet wide and 22 feet deep at Potopotank, and another 22 feet deep and 160 to 260 feet wide at West Point bar. A training dike 10,142 feet long has been constructed at West Point bar, of which 4,818 linear feet has been rebuilt and 3,474 linear feet has been repaired. The total amount of material dredged from the channels is about 1,160,100 cubic yards.

The entire project is now about 60 per cent completed.

The work of maintenance during the fiscal year consisted in rebuilding the dike, repairs to plant, and miscellaneous incidental work.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was about 19 feet. The mean range of tides is about 3 feet. York River is navigable, throughout its entire length of 41 miles, to West Point at its head.

The principal articles of commerce are lumber, oysters, cord wood, tobacco, railroad ties, farm produce, ship timber, piles, and general merchandise. The receipts and shipments during 1908 amounted to about 178,445 tons, and were estimated to be worth about $7,222,846.

The work done has been of much importance to commerce, and it is understood that freight rates have been somewhat reduced.

It is proposed to apply the additional appropriation recommended to the repair of the dike and to redredging the channels.

The additional work proposed is for maintenance of work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1886, 1887, and 1894.

For reference to report on examination and survey of York River see page 201 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended	$6,806.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909	23,000.00
	29,806.59
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	8,619.77
July 1, 1909, balance unexpended	21,186.82
July 1, 1909, outstanding liabilities	1,894.28
July 1, 1909, balance available	19,292.54
July 1, 1909, amount covered by uncompleted contracts	7,138.69
Amount (estimated) required for completion of existing project	59,689.95
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Mattaponi River.*—The Mattaponi River is navigable for small steamers and vessels from its mouth to Aylett, about 39 miles above, and navigable for small lighters and rafts from Aylett to Monday bridge, 16 miles farther. At the time of the adoption of the project the obstructions to 5½-foot navigation below Aylett consisted of 7 bars, upon which the ruling depths at low tide varied from 2.4 to 3.8 feet. Above Aylett there were numerous bars, but no work upon them has been proposed. The river was also obstructed by snags, wrecks, and overhanging trees.

The original project for improvement, adopted June 14, 1880, provided for the removal of snags, wrecks, and leaning trees below Monday bridge, and the improvement of the bars below Aylett, so as to give a depth of 5½ feet at low tide and a channel width of 40 feet, at an estimated cost of $34,059. This project was extended by the terms of the river and harbor act of July 13, 1892, which provided for the removal of snags as far up as Guineas bridge, near Milford station, on the Richmond, Fredericksburg and Potomac Railroad. The estimated cost of this, which is the present project, is $72,100.

The amount expended to June 30, 1909, was $51,790.84, of which $18,022.34 has been applied to maintenance since March 3, 1899. This expenditure resulted in the removal of snags, logs, and overhanging trees from the river between the mouth and Monday bridge, and in keeping the river below Aylett free from such obstructions; in constructing 2,297 linear feet of dike at Robinson bar, and in dredging channels of the full projected dimensions through Line Tree, Latané, Robinson, Presque Isle, Sales, Walker, and Jones bars. The total amount of material dredged from the channels is about 69,613 cubic yards. The entire project is now about 35 per cent completed.

The work of maintenance during the fiscal year consisted of dredging, of snagging the river, and of engineering and miscellaneous incidental office expenses.

The maximum draft that could be carried at mean low water over the shoalest part of the channel June 30, 1909, was 3 feet at Walker bar. The mean range of tide is about 3.5 feet.

---

[a] See consolidated money statement on page 262.

The principal articles of commerce are lumber, cord wood, farm produce, railroad ties, ship timber, piles, and general merchandise. The receipts and shipments during 1908 amounted to about 95,069 tons, and were estimated to be worth about $1,329,548.

The work done has been of considerable benefit to commerce, and it is understood that not only have shipments been facilitated, but that freight rates have been somewhat reduced.

It is proposed to apply the additional appropriation recommended to dredging, dike construction, and to snagging.

The additional work proposed is partly necessary to make the improvement available, partly for the extension of benefits and partly for the preservation of work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

For reference to reports on examinations and surveys of this locality, see page 212 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended		$10,588.16
Amount allotted from appropriation by river and harbor act approved March 3, 1909		7,500.00
Amount received by transfer and allotment		[a]9,181.31
		27,269.47
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$4,009.58	
For maintenance of improvement	15,769.42	
		19,779.00
July 1, 1909, balance unexpended		7,490.47
July 1, 1909, outstanding liabilities		350.08
July 1, 1909, balance available		7,140.39
Amount (estimated) required for completion of existing project		30,841.03
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		([b])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(c) *Pamunkey River.*—At the time of the adoption of the project for the improvement of Pamunkey River, a draft of 7 feet could be carried at low tide to Buckland bar, 38½ miles above its mouth. Between this bar and Bassett Ferry, a distance of 8½ miles, there were four bars, the ruling depths on which varied from 2½ to 5½ feet. Besides these bars the river was obstructed by wrecks, logs, snags, and overhanging trees.

The original, which is also the existing, project for the improvement of this river was adopted June 14, 1880, and amended in 1885 and 1908. It contemplates securing a channel 7 feet deep and 100 feet wide between Bassett Ferry and the mouth of the river, this result to be obtained by dredging and the construction of dikes, the latter being also designed to secure the dredged material deposited behind them. The wrecks, snags, logs, and trees obstructing navigation are also to be removed. The estimated cost of the revised project is $55,000. It is estimated that an expenditure of $5,000 is now required for maintenance, in addition to the work which can be done with available funds, and that in future the cost of maintenance will be $4,000 every four years.

---

[a] $5,981.31 net allotment from appropriation of March 3, 1905, for emergencies in river and harbor works; $2,200 transferred from Occoquan Creek; $1,000 transferred from Carters Creek.

[b] See consolidated money statement on page 262.

The amount expended to June 30, 1909, was $34,263.57, of which $4,073.99 was applied to maintenance after March 3, 1899. This expenditure has resulted in dredging channels 100 feet wide and 7 feet deep through Buckland bar, 70 feet wide and 7 feet deep through Hogan bar, and 95 feet wide and 6 to 7 feet deep through Skidmore bar; in the construction of 1,478 linear feet of sheet pile dikes at Spring and Skidmore bars; in the construction of 14 permeable spur dikes, aggregating in length 2,332 linear feet, at Buckland and Hogan bars; in removing parts of eight wrecks, and in removing snags and similar obstructions from about 50 miles of river and keeping it free from such obstructions. The total amount of material dredged from the channels is about 24,485 cubic yards.

The entire project is now about 55 per cent completed.

The work of improvement done during the fiscal year consisted of dredging, and construction of permeable spur dikes and the incidental expenses thereto were $5,754.97. The work of maintenance done during the fiscal year consisted of resnagging the lower 50 miles of river and its incidental expenses were $1,201.94.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was 5 feet. The mean range of tide is about 3½ feet. Bassett Ferry, 47 miles above the mouth of the river, is the head of navigation for vessels drawing 5 feet and navigation by small lighters and rafts extends about 15 miles above.

The principal articles of commerce are lumber, cord wood, railroad ties, ship timber, piles, and grain. The receipts and shipments during 1908 amounted to about 49,107 tons and were estimated to be worth about $559,516.

The work done has been of benefit to commerce, and it is understood that not only have shipments been facilitated, but freight rates have been reduced.

It is proposed to apply the additional appropriation recommended to dredging, snagging, and dike construction, as provided for by the approved project.

The additional work proposed is necessary to make the improvement available, and for maintenance and preservation of the work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

For reference to the report on an examination and survey of Pamunkey River, see page 213 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended		$8,093.34
Amount allotted from appropriation by river and harbor act approved March 3, 1909		7,500.00
		15,593.34
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$5,754.97	
For maintenance of improvement	1,201.94	
		6,956.91
July 1, 1909, balance unexpended		8,636.43
July 1, 1909, outstanding liabilities		75.42
July 1, 1909, balance available		8,561.01
Amount (estimated) required for completion of existing project		16,173.99
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		([a])

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*d*) *Occoquan Creek.*—In 1872 navigation in Occoquan Creek, a tributary of the Potomac River, was obstructed by three bars, over which but 1.2 feet could be carried at low tide. Aside from these obstructions the creek was amply wide and deep at low tide for vessels drawing up to 5 feet.

The original project for improvement, adopted March 3, 1873, and modified in 1879, provided for dredging channels 100 feet wide and 5 feet deep through the bars below the town of Occoquan, and the construction of a dike at Sand bar, at an estimated cost of $25,000. Four appropriations were made from 1873 to 1878, aggregating $25,000, and in 1880 the improvement was regarded as completed.

The existing project for this stream, adopted September 19, 1890, and extended by act of March 2, 1907, contemplates the dredging of channels 6 feet deep through the five bars obstructing 6-foot navigation below the town of Occoquan. These channels are to be 100 feet wide, except through the outer bar and the lower 2,000 feet of the bar next above it, where the channel is to be 150 feet wide. Dikes are to be constructed at the upper three bars. The estimated cost of the project as modified is $64,000.

The amount expended under the existing project to June 30, 1909, was $50,797.97, of which $14,713.63 was applied to maintenance subsequent to March 3, 1899. As a result of this expenditure, channels of the full projected dimensions have been dredged through all of the bars and redredged where shoaling occurred, and 1,696 linear feet of dike has been constructed at Occoquan bar and Sand bar and repaired where injured by freshets and ice.

The total amount of material dredged from the channels is about 341,145 cubic yards. There has been placed in the dikes about 6,475 cubic yards of stone.

The entire project is now about 60 per cent completed.

The work of maintenance during the year consisted in an inspection and miscellaneous office work.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement was 6 feet. The mean range of tide is about 2 feet. The town of Occoquan, 6 miles above the mouth, is the head of navigation.

---

[a] See consolidated money statement on page 262.

The principal articles of commerce are railroad ties, building sand, piles, cord wood, lumber, grain, farm produce, coal, and flour. The receipts and shipments during 1908 amounted to about 25,958 tons, and were estimated to be worth $101,931.

The work done has been of great benefit to navigation in this creek, and it is understood that not only have shipments been facilitated, but freight rates have been materially reduced.

It is proposed to apply the additional appropriation recommended to construction of dikes and maintaining the channels of the project.

The additional work proposed is for the purpose of extension of benefits and maintenance of the work already done.

For reference to reports on examinations and surveys of this locality see pages 202 and 203 of the Annual Report of the Chief of Engineers for 1904 and page 237 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1908, balance unexpended		$4,188.24
Amount allotted from appropriation by river and harbor act approved March 3, 1909		1,000.00
		5,188.24
Amount transferred to Mattaponi River		2,200.00
		2,988.24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,285.77	
For maintenance of improvement	401.03	
		1,686.80
July 1, 1909, balance unexpended		1,301.44
Amount (estimated) required for completion of existing project		26,614.22
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*e*) *Carters Creek.*—Before improvement the entrance to Carters Creek, a tidal estuary of the Rappahannock River, was obstructed by a bar over which but 10½ feet could be carried at low tide, and navigation was rendered difficult near Gallyhook Point within the creek by the projection of this point into the channel, which was about 12 feet deep at low tide.

The original, which is also the exisiting, project for this improvement was adopted June 13, 1902, and provides for dredging a channel at the mouth to afford a navigable depth at low tide of 15 feet, with a width of 200 feet, including necessary widening at Crab Point, for the construction of a jetty for the protection of this channel, and for the dredging of a channel 12 feet deep and 100 feet wide at Gallyhook Point, at a total estimated cost of $35,700.

The amount expended to June 30, 1909, was $28,525.63, $128.08 of which was applied to maintenance. As a result of this expenditure a channel 200 feet wide and 15 feet deep has been dredged through the bar at the mouth of the creek. The bar at the end of Crab Point has

---

[a] See consolidated money statement on page 262.

been dredged to a depth of 15 feet within the channel limits. A channel 100 feet wide and 12 feet deep has been excavated at Gallyhook Point. A stone jetty 742 feet long has been constructed at the mouth of the creek. Harbor lines have been established. The total amount of material dredged from the channels is 65,893 cubic yards. There has been placed in the jetty 1,507 cubic yards of stone. The entire project is now completed.

The work of maintenance during the year consisted in an inspection and miscellaneous office work.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the outer bar was 15 feet, and at Gallyhook Point was 12 feet. The mean range of tide is 1.5 feet. Irvington, about 1½ miles above the mouth of the creek, is the head of navigation for large steamers, while small sailing vessels drawing up to 5 feet can ascend about 1 mile farther.

The principal articles of commerce are fish, oysters, lumber, coal, guano, fish oil, wood, bricks, ice, farm produce, canned goods, and general merchandise. The receipts and shipments during 1908 amounted to about 58,825 tons and were estimated to be worth $941,275. There is a good passenger trade in Carters Creek, which is also an important harbor of refuge.

The work done has been of considerable benefit to commerce, but as far as known has had no effect upon freight rates.

The work contemplated in the project being completed, no further appropriation is asked for at present. It is anticipated that an appropriation of about $5,000 every eight years will be required for maintenance.

For reference to the report upon an examination and survey of Carters Creek, see page 206 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended		$1,526.15
Amount allotted from appropriation by river and harbor act approved March 3, 1909		1,000.00
		2,526.15
Amount transferred to Mattaponi River		1,000.00
		1,526.15
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$335.22	
For maintenance of improvement	128.08	
		463.30
July 1, 1909, balance unexpended		1,062.85

CONSOLIDATED.

July 1, 1908, balance unexpended		$31,202.48
Amount allotted from appropriation by river and harbor act approved March 3, 1909		40,000.00
Amount received by allotment		5,981.31
		77,183.79
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11,385.54	
For maintenance of improvement	26,120.24	
		37,505.78
July 1, 1909, balance unexpended		39,678.01
July 1, 1909, outstanding liabilities		2,319.78
July 1, 1909, balance available		37,358.23

July 1, 1909, amount covered by uncompleted contracts	$7,138.69
Amount (estimated) required for completion of existing project	133,319.19
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K 5.)

6. *Nomini Creek, Virginia.*—Before improvement the navigation of Nomini Creek, a tributary of the Potomac, was obstructed by a bar at its mouth over which but 3 feet could be carried at low tide. Except for this bar a draft of 8 feet could be carried to Nomini Ferry, 4 miles above the mouth, and 5 feet could be carried 2 miles farther to the head of navigation.

The project for this improvement, adopted March 3, 1873, and modified in 1879, 1885, 1888, 1890, 1897, and 1908, provides for a channel through the bar 150 feet wide and 9 feet deep, with a jetty about 2,370 feet long at the mouth. The finally revised estimate of cost is $105,000.

The amount expended to June 30, 1909, was $82,686.52, of which $4,008.71 was applied to maintenance subsequent to March 3, 1899. As a result of this expenditure the channel has been dredged to a depth of 9 feet at low tide, with a width of 140 to 150 feet, and redredged, and 2,110 linear feet of jetty has been constructed. The total amount of material dredged from the channel is about 136,000 cubic yards. There have been placed in the jetty about 6,014 cubic yards of stone and 3,000 cubic yards of oyster shells. The entire project is now about 85 per cent completed. No work of maintenance was done during the fiscal year ended June 30, 1909. The work of improvement consisted in the extension of the jetty and miscellaneous office expenses, amounting to $3,757.83.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was 9 feet. The mean range of tide is 1.8 feet.

The principal articles of commerce are farm produce, lumber, cord wood, fertilizer, grain, railroad ties, oysters, canned goods, fish, and general merchandise. The receipts and shipments during 1908 amounted to about 22,760 tons and were estimated to be worth about $944,150.

The work done has been of substantial benefit to navigation, and it is understood that freight rates have been considerably reduced and shipments much facilitated.

It is proposed to apply the additional appropriation recommended to the extension and maintenance of the jetty, and redredging the channel to obtain the required width.

The additional work proposed is for the purpose of extension of benefits and for the preservation of the work already done.

A map of the locality may be found in the Annual Report of the Chief of Engineers for 1889.

For reference to a report on an examination and survey of Nomini Creek, see page 207 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended	$71.31
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	4,071.31
June 30, 1909, amount expended during fiscal year, for works of improvement	3,757.83
July 1, 1909, balance unexpended	313.48
July 1, 1909, outstanding liabilities	122.30
July 1, 1909, balance available	191.18
July 1, 1909, amount covered by uncompleted contracts	101.40
Amount (estimated) required for completion of existing project	26,008.71
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix K 6.)

7. *Rappahannock River, Virginia.*—The lower portion of the Rappahannock River is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

The obstructions to navigation before improvement was undertaken consisted of 9 bars in the upper portion of the river between Tappahannock and Fredericksburg, over which the ruling depths were from 4 to 10½ feet. Seven of the bars were in the 12½ miles of river below Fredericksburg. Of these bars Fredericksburg bar, with a least depth of 4 feet, and Spottswood bar, 4 miles below Fredericksburg, with a least depth of 6 feet, caused the most delay to steamboats and vessels.

The project for this improvement, adopted March 3, 1871, as modified in 1879 and in 1905, provides for securing a channel 12 feet deep and 100 feet wide between Fredericksburg and Port Royal and 12 feet deep and 200 feet wide between Port Royal and the mouth of the river, this result to be obtained by dredging and the construction of dikes, the latter being also designed to secure the excavated material deposited behind them.

The total estimated cost of the revised project was $363,288.86, exclusive of work properly chargeable to maintenance and estimated in 1905 to cost $38,500. The project on which this estimate was based was adopted by Congress by act approved March 2, 1907. This act authorized an expenditure of $90,000 in excess of the amounts therein and theretofore appropriated. This makes the limit of cost of the revised project $393,633.12, including all necessary work properly chargeable to maintenance on June 30, 1907. The contract authorization of $90,000 has since been appropriated. The estimated annual cost for further maintenance is $10,000.

The amount expended to June 30, 1909, was $464,156.27, of which $100,985.78 has been applied to maintenance since March 3, 1899. The sum of $59,933.18 was expended prior to March 3, 1899, in redredging freshet deposits and in repairs to dikes.

The following sums have been obtained from other sources than appropriations: Damages recovered from contractor's sureties, $1,000, and proceeds of sale of property, $110; total, $1,110. This sum had not been expended at the close of the fiscal year.

The expenditure has resulted in the completed improvement of 13 and in the partial improvement of 7 bars between Fredericksburg and the mouth of the river by means of dredging and rock excavation, construction of dikes, and removal of two wrecks which obstructed navigation. About 1,098,530 cubic yards of material has been dredged, 1,537 cubic yards of rock excavated, 33,495 linear feet of dikes constructed, 8,290 linear feet of dikes repaired, 915 linear feet of riprap dike constructed, and 1,655.8 cubic yards of riprap stone used.

The entire project is now about 90 per cent completed, but it is estimated that $10,000 per annum is required for maintenance. The work carried on during the year resulted in completing all the dikes called for by the approved project, in completing channels to the full projected dimensions through 13 bars, in partially completing channels through 3 bars, protecting spoil-banks from freshet erosion, and in other miscellaneous work. The incidental expenditure was $65,020.51, of which $14,079.73 was applied to maintenance. Dredging was carried on under a continuing contract.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the locality under improvement was about 9 feet. The mean range of tide is about 3 feet. Fredericksburg, 106 miles above the mouth, is the head of navigation for steamers and barges. Falmouth, 3 miles farther up, is the head of navigation for small scows, lighters, and launches.

The principal articles of commerce are railroad ties, lumber, farm produce, grain, cord wood, fertilizers, flour, canned goods, coal, manufactures, and general merchandise. The receipts and shipments during 1908 amounted to about 395,842 tons, and were estimated to be worth about $6,485,797.

The work done has been of benefit to commerce, and it is understood that freight rates have been reduced.

It is proposed to apply the additional appropriation recommended toward the maintenance of dredging, of dike construction, of work already done, and work that will be completed with funds now in hand.

At Fredericksburg bar new deposits of sand are formed by each recurring freshet, and shoaling is also constantly taking place, though less rapidly, at some of the lower bars. This explains the estimate of $10,000 being required annually for maintenance.

Maps of this locality may be found in the Annual Reports of the Chief of Engineers for 1880, 1881, 1883, 1886, 1887, 1888, 1890, 1906, and 1909.

For reference to the report on an examination and survey of Rappahannock River, see page 208 of the Annual Report of the Chief of Engineers for 1904, and for the report of the survey submitting the revised project, see page 1110 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1908, balance unexpended		$95,203.24
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
Amount appropriated by sundry civil act approved March 4, 1909		32,000.00
		142,203.24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$50,940.78	
For maintenance of improvement	14,079.73	
		65,020.51
July 1, 1909, balance unexpended		77,182.73
July 1, 1909, outstanding liabilities		791.33
July 1, 1909, balance available		76,391.40
July 1, 1909, amount covered by uncompleted contracts		58,403.67
Amount (estimated) required for completion of existing project		7,332.27
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix K 7.)

8. *Urbana Creek, Virginia.*—Before the improvement of Urbana Creek, a tributary of the Rappahannock, a bar existed outside the mouth, over which but 6½ feet could be carried at low tide, and there was a shoal within the creek with a ruling depth of 7 feet.

The project for this improvement, adopted March 3, 1879, and modified in 1883, 1888, and 1897, provides for dredging a channel 150 feet wide and 10 feet deep through the outer and inner bars, with a turning basin of the same depth at the head, for a series of spur dikes at Bailey Point, and for a stone jetty to protect the cut through the outer bar. The final revised estimate of cost is $70,000.

The amount expended to June 30, 1909, was $43,319.78, of which $10,989.48 has been applied to maintenance since March 3, 1899. As a result of this expenditure there has been dredged a channel 10 feet deep and 150 feet wide through the outer bar, a channel 10 feet deep and 150 feet wide through the inner bar, and a turning basin 10 feet deep at the steamboat wharf. These channels have been redredged where shoaling had occurred.

Harbor lines have been established. Seven hundred and eighty-three linear feet of jetty has been constructed. The total amount of material dredged from the channel is about 144,300 cubic yards. There has been placed on the jetty about 1,095.4 cubic yards of stone.

The work during the fiscal year consisted in entering into a contract for the extension of the jetty, in a survey, in an inspection, and in miscellaneous office work, the incidental expenditure thereto being $180.37, which was applied to maintenance.

The maximum draft that could be carried on June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was about 10 feet. The mean range of tide is 1.5 feet. The town of Urbana, at the mouth of the creek, is the head of navigation for steamers and large vessels, while small vessels ascend the stream for a distance of 3 or 4 miles.

The principal articles of commerce are lumber, oysters, cord wood, excelsior, coal, farm produce, canned goods, railroad ties, bricks, pickles, manufactured clothing, fertilizer, and general merchandise. The receipts and shipments during 1908 amounted to about 29,000 tons, and were estimated to be worth $991,503.

The work done has been of benefit to commerce, and it is understood that freight rates have been reduced.

Work on this improvement was suspended between 1903 and 1907 pending the result of legal proceedings instituted by the Government to secure the removal of part of a wharf which projected into the proposed channel and which had been built in violation of the provisions of the act of March 3, 1899.

The wharf was finally altered in accordance with the requirements of the War Department.

It is proposed to apply the additional appropriation recommended to the extension and maintenance of the jetty, the construction of a spur dike at Bailey Point, and the redredging of the outer bar.

The additional work proposed is partly for the extension of benefits and partly for the preservation of the work already done.

For reference to the reports on examinations and surveys of Urbana Creek, see page 210 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended	$360.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	4,360.59
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	180.37
July 1, 1909, balance unexpended	4,180.22
July 1, 1909, amount covered by uncompleted contracts	2,640.00
Amount (estimated) required for completion of existing project	33,489.48
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	17,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K 8.)

9. *Harbor at Milford Haven, Virginia.*—Milford Haven is a tidal estuary of Chesapeake Bay, about 4 miles long and from one-half to 1 mile wide. The depth in the channel ranges from 6½ to 15 feet, and in the portion navigated by steamers is generally 9 feet or more. The haven has two entrances, one at the northwest end from Hills Bay, an arm of Piankatank River, and another at the southeast end, from Chesapeake Bay. Both entrances are obstructed by bars. The southeast entrance is exposed, and as the bar has a ruling depth of but 3 feet is seldom used. The bar which obstructed the northwest entrance had, before improvement, a ruling depth of 8 feet. A bar also existed within the haven between Cricket Hill and Callis wharves, with a ruling depth of about 8 feet.

The project for this improvement, adopted March 3, 1899, and modified in 1902, provides for securing channels 10 feet deep by a minimum width of 200 feet through both bars, viz, at the northwest entrance and between Cricket Hill and Callis wharves, at an estimated cost of $17,500.

The amount expended to June 30, 1909, was $20,475.16, $113.65 of which was applied to maintenance. The sum of $3,032.97 was recovered as judgment from a failing contractor. As a result of this expenditure channels of the full projected dimensions have been dredged through both bars, and a jetty 333 feet long has been constructed to maintain the outer channel.

For reasons given in his report herewith (Appendix K 9) the district officer recommends that the existing jetty be extended about 800 feet at an estimated additional cost of $10,000, as an aid in maintaining the dredged channels. This recommendation is concurred in by the Board of Engineers for Rivers and Harbors and by the Chief of Engineers.

The maximum draft that could be carried June 30, 1909, at mean low tide over the shoalest part of the locality under improvement was 10 feet. The mean range of tide is about 1.3 feet. The haven is navigable throughout its entire length by vessels drawing 6 feet, and Fitchett's wharf, about 3 miles above the northwest entrance, is the highest point reached by the large steamers.

The principal articles of commerce are oysters, fish, crabs, farm produce, fertilizers, piles, hay and feedstuffs, lumber, building materials, flour, ice, and general merchandise. The receipts and shipments during 1908 amounted to about 32,570 tons, and were estimated to be worth about $908,600.

The work done has been of considerable benefit to commerce and navigation. Freight rates have, however, been advanced.

It is proposed to apply the additional appropriation recommended to the maintenance of the completed channels of the project by dredging.

The additional work proposed is for the purpose of extension of benefits and maintenance of the work already done. It is anticipated that an appropriation of about $4,000 every eight years will be required for maintenance.

For reference to reports on examinations and surveys of this locality, see page 211 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended		$171.46
June 30, 1909, amount expended during fiscal year:		
Carried to surplus fund	$57.81	
For maintenance of improvement	113.65	
		171.46
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement		[a]3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix K 9.)

---

[a] In addition to this amount the sum of $10,000 could be profitably expended in extending the jetty, if authorized by Congress.

10. James River, Virginia.—The original condition of the James, before its improvement by the General Government was begun in 1870, was as follows:

The ruling depth to the lower city line of Richmond was 7 feet at mean low water. This depth obtained on Rocketts reef, immediately below Richmond, and on Richmond bar, 2 miles below. Some 15 miles lower down, in Trents reach, was a shoal on which there was a depth of only 8 feet. This, however, ceased to be an obstruction in January, 1872, when the 5-mile reach in which it was situated was cut off by the opening of Dutch Gap Canal.

In addition to the above natural obstructions there were, in the 10 miles of river below Richmond, wrecks in the channel at Chaffins Bluff and Graveyard reach, and obstructions placed during the civil war at Warwick bar and Drewry Bluff, consisting at each locality of a military bridge, lines of stone cribs, and sunken vessels. In addition to all these obstructions, the channel between Richmond and Trents reach was in many places narrow and tortuous.

Between Trents reach and City Point, a distance of 18½ miles, the ruling depth was 13 feet, which obtained near Varina or Aikens Landing. Between City Point and the mouth of James River the ruling depth was 15 feet, existing at Harrisons bar and Goose Hill flats, then 43 and 76 miles, respectively, below Richmond.

It was contemplated in the original project, adopted in 1870, to secure a channel having a depth of 18 feet at high tide and a width of 180 feet. The amount expended prior to the adoption of the present project was $763,000, which includes $23,000 appropriated in 1836 and 1852.

The project under which the improvement is now being carried on was adopted July 5, 1884. It provides for the formation by means of regulation works and excavation of a channel between the mouth of the river and the lower city line of Richmond, having a depth of 22 feet at mean low tide, and a width from the mouth to City Point of 400 feet; thence to Drewry Bluff of 300 feet, and thence to Richmond of 200 feet, at a total estimated cost of $4,500,000.

The act of June 13, 1902, provided for extending the improvement from the lower city line of Richmond to the head of navigation at the docks, at an additional cost of $724,943.15. The work proposed under this extension consists of excavating a channel about 3,300 feet long and 200 feet wide, with a depth of 22 feet at mean low water.

By act of March 3, 1905, the original project was further extended to include the excavation of a turning basin at Richmond, by increasing the width of the proposed improved channel to 400 feet for a length of 600 feet, the depth to be 22 feet, at a cost not to exceed $150,000. This makes the total estimated cost of the improvement $5,374,943.15.

The amount expended on the present project to June 30, 1909, was $1,799,033.13, of which $57,799.86, expended subsequent to March 3, 1899, was for maintenance. This item of maintenance includes the cost of dredging sand deposited in the channel by the river during the execution of the work in excess of the quantity originally estimated; also repairs to jetties.

The improvement of the river has been chiefly confined to the upper reaches, where the water was shoalest, and consequently where the greatest benefits to commerce would be obtained. The exceptions to this were the dredging of shoals at Harrisons bar, Swans Point, and Goose Hill flats to a depth of 18 feet.

The project is estimated to be about one-third completed.

The result of the work of improvement is a channel between Hampton Roads and the city wharf at Richmond, Va., having, with few exceptions, a width of not less than 100 feet and a depth of 18 feet at mean low water. The exceptions are Rocklanding shoal, about 89 miles below Richmond, with a depth of 16.1 feet; Dancing Point shoal, about 60 miles below Richmond, with a depth of 16½ feet, and Willis, Varina, and Deep Bottom reaches, about 9 miles, 16 miles, and 18 miles, respectively, below Richmond, the respective ruling depths on which are 16.8, 17, and 17 feet.

The work of maintenance during the year consisted in redredging the channel at Warwick bar, about 4½ miles below Richmond.

The maximum draft that could be carried at low water on June 30, 1909, between the city wharf at Richmond and the mouth of the river was 16.1 feet.

The mean tidal range varies for different parts of the river, being approximately as follows: 2½ feet at Fort Monroe, 1.85 feet at Jamestown, 3 feet at City Point, 3½ feet at Dutch Gap, and 4 feet at Richmond.

The channel length of the James River from Hampton Roads to the head of navigation at Richmond, Va., is 103.8 miles.

It is proposed to apply the available balance of funds to enlarging the channel for about 1½ miles from a point 800 feet below the city line of Richmond, and for some 1,600 feet from a point about 2½ miles below the same line, and to dredging and jetty work at Willis, Kingsland, Varina, and Deep Bottom reaches, situated from about 9 to 18 miles below Richmond.

The appropriation recommended will be applied to maintenance of improvement by dredging; also to enlarging channel between Richmond, Va., and the mouth of Appomattox River, by dredging and extending existing regulation works, excavating a channel through Dancing Point shoal, 300 feet wide by 22 feet deep at low water, and excavating a channel through the south side of Rocklanding shoal, 400 feet wide by 22 feet deep at low water, for the extension of benefits.

The commerce of the river for the calendar year of 1908 amounted to 256,298 tons at Richmond, Va., and 205,970 tons for landings below, or an aggregate of 462,268 tons, a decrease of about 17½ per cent from the tonnage of 1907. The value of the freight transported amounted to $29,329,589.

The decrease in tonnage in 1908 from that of 1907 is, to some extent, attributable to the traffic in the latter year having been increased on account of the Jamestown Exposition.

The principal articles of commerce comprised coal, coal oil, cord wood, lumber, fertilizer, and brick.

The improvement of the river has been beneficial in lowering railroad freight rates and in reducing the cost of river transportation.

Reports on examinations and surveys are found in Senate Executive Document No. 1, Thirty-third Congress, first session, Part 2, 1853, page 389, and in Annual Reports of the Chief of Engineers of

1875, page 74; of 1878, page 459; of 1882, page 870; of 1887, page 873; of 1890, page 996; of 1896, page 1010; and of 1900, page 1754.

More extended information concerning the improvement is contained in Annual Reports of the Chief of Engineers of 1871, pages 603 to 605; of 1882, pages 870 to 887; and of 1900, pages 1757 to 1760.

Maps of James River are contained in the Annual Reports of the Chief of Engineers for 1876, 1900, and 1904, and in House Document No. 234, Fifty-sixth Congress, first session.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended		$228,118.75
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		238,118.75
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$140,871.44	
For maintenance of improvement	3,447.94	
		144,319.38
July 1, 1909, balance unexpended		93,799.37
July 1, 1909, outstanding liabilities		1,310.42
July 1, 1909, balance available		92,488.95
July 1, 1909, amount covered by uncompleted contracts		56,129.64
Amount (estimated) required for completion of existing project		3,539,910.51
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		500,000.00

TURNING BASIN.

July 1, 1908, balance unexpended	$329.63
June 30, 1909, amount expended during fiscal year for works of improvement.	329.63

(See Appendix K 10.)

11. *Construction of piers, Hampton Roads, Jamestown Exposition.*—The original project was adopted by act of Congress, approved June 30, 1906, and provided for the construction, from plans furnished by the Jamestown Exposition Company and approved by the Secretary of War, of two piers extending from the exposition grounds into the waters of Hampton Roads, the piers to be connected at their outer ends by an arch sufficiently high to permit small craft to enter under it into a basin or harbor to be dredged to a sufficient depth to accommodate boats drawing not more than 10 feet at mean low tide, at a total cost not to exceed $400,000.

This project was modified by act of Congress approved February 9, 1907, which provided, in addition to the work described above, for dredging a channel from deep water in Hampton Roads to the government piers at the Jamestown Exposition, and for dredging in Bush Creek to accommodate the needs of the life-saving exhibit, at a cost not to exceed $65,000.

Actual construction work on the piers was begun during December, 1906, and was pushed continuously from that time until completed in September, 1907.

The total amount expended was $447,669.44.

On September 14, 1907, the piers were transferred to the Jamestown Exposition Company, in accordance with the terms of the act of Congress.

The balance of appropriations, amounting to $17,330.56, reverted to the Treasury on October 26, 1908.

July 1, 1908, balance unexpended	$18,416.96
June 30, 1909, amount expended during fiscal year	1,086.40
Reverted to the Treasury	17,330.56

(See Appendix K 11.)

12. *Removing sunken vessels or craft obstructing or endangering navigation—(a) Wreck of pile driver in the Pamunkey River, Virginia.*—By letter dated May 11, 1908, Mr. H. T. Faunt Le Roy reported the existence of a sunken pile driver at Cumberland Landing on the Pamunkey River at a point where the river was narrow and currents unfavorable, the wreck thus constituting a "great menace to navigation."

Subsequent correspondence and examinations established the fact that the party responsible for this wreck was Mr. E. Wilkinson, of West Point, Va. The wreck was removed by Mr. Wilkinson on July 7, 1908. The incidental cost of the inspections was $25.

(*b*) *Seven wrecks on the flats of the Anacostia River.*—Seven abandoned coal barges, canal boats, etc., have been beached for several years on the flats of Anacostia River, near the outlet of James Creek Canal. Two of these barges were floated on high water during May, 1908, across the Anacostia River and lodged on the riprap wall of the area to be reclaimed.

In order that the remaining five barges should not under like circumstances be floated and become a menace to navigation, their destruction was authorized. The barges were burned to the water's edge, and the two that had lodged on the riprap wall were placed on the area to be reclaimed.

The cost of the work was $50.

(*c*) *Wreck of barge in Alexandria Harbor, Virginia.*—During the examination of the harbor of Alexandria certain persons stated that in their opinion the wreck of a barge was the cause of the shoaling along the water front of Alexandria, Va. The work was done after public notice and written acceptance between June 15 and August 6, 1908. Nothing of value was obtained.

The cost of removal and incidental expenses were $1,000, of which amount $75.33 were expended in the fiscal year 1908.

(*d*) *Wreck of schooner E. G. Irwin, off Point Lookout, at the mouth of Potomac River, Maryland.*—This wreck was reported on September 15, 1908, to be a menace to navigation, and this report was confirmed by an examination. The work was done by government plant and hired labor between November 11 and 21, 1908, at the cost of $700.

The total expenditure during the year on the removal of wrecks in this district was $1,699.67.

(See Appendix K 12.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH THE RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated July 26, 1907, and October 14, 1908, on preliminary examination and survey, respectively, of *Potomac River at Alexandria, Va., with a view to the removal of a bar recently formed*, required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1253, Sixtieth Congress, second session. . A plan for improvement at an estimated cost of $116,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE NORFOLK, VIRGINIA, DISTRICT.

This district was in the charge of Maj. Joseph E. Kuhn, Corps of Engineers. Division engineer, Col. Dan C. Kingman, Corps of Engineers.

1. *Harbor at Norfolk and its approaches, Virginia.*—(*a*) *General improvement.*—In its original condition the main channel of this harbor was at mean low water navigable by vessels of 20 feet draft as far as the navy-yard, on the Southern Branch of the Elizabeth River, while in the Eastern Branch of this river there was a channel 15 feet in depth at mean low water as far as the Campostella bridge. These channels were of varying width.

The original project of improvement was adopted in 1878, revised in 1885, and amended in 1890, 1898, and 1905. It included the attainment of a channel from 500 to 700 feet wide and 25 feet deep at mean low water from Hampton Roads to the navy-yard, a branch channel 22 feet deep at the same stage of the tide to the Campostella bridge on the Eastern Branch, and, within the limits of the first-named channel, a channel 450 feet wide and 28 feet deep at mean low water from deep water in Hampton Roads to the navy-yard. There has also been included in the project the excavation of an anchorage at the mouth of the Western Branch, having an area of 56 acres and a depth of 25 feet at mean low water, and the dredging, to the depth of 28 feet at mean low water, of the area between the western edge of the main channel and a line 75 feet outside of the established pierhead line, along the railroad docks at Pinner Point. The cost of all this work was estimated at $1,623,790.98.

The existing project of improvement is the original project modified from time to time as stated above, under which the first appropriation for work was made August 14, 1876.

To June 30, 1909, there had been expended on this existing project $1,669,862.63, of which sum $51,052.16 was for work of maintenance. The sum of $24.71 has been derived from the sale of property and blueprints.

The amount expended during the fiscal year was in payment of outstanding liabilities due for new work at the close of the fiscal year 1908, and for expenses of an examination made of the area dredged in that fiscal year.

On June 30, 1909, the project is about 99.5 per cent completed, the only work remaining to be done being the dredging of a strip 20 feet wide and 2,600 feet long from the south side of the channel in the Eastern Branch between the Norfolk and Western Railroad and Campostella highway bridges, for which purpose the estimate for completion has been increased by $5,000.

On June 30, 1909, the main channel of the harbor was available at mean low water for vessels of 28 feet draft as far as the navy-yard, which is located about 10 miles from deep water in Hampton Roads. The Eastern Branch channel is available at mean low water for vessels drawing 22 feet as far as the Campostella bridge, about 11 miles from deep water in Hampton Roads. The normal range of the tide is 2.7 feet.

The Southern Branch of the Elizabeth River is navigable as far as the Albemarle and Chesapeake Canal locks, a distance of about 11 miles above the confluence of the Eastern and Southern branches of this river. The Eastern Branch is navigable for about 5 miles above this confluence. From this confluence to deep water in Hampton Roads the distance by the main river is about 9 miles.

For the calendar year 1908 the water-borne shipments aggregated about 11,746,746 tons, valued at about $843,563,326. The chief products handled are coal, cotton, fertilizer, lumber, and agricultural products. The improvement has made Norfolk an important shipping point for bituminous coal from the West Virginia fields, and a new railroad, the Virginian, recently completed, commenced loading cargo and bunker coal at its pier on the Elizabeth River in April last.

It has not been found practicable to ascertain what effects, if any, the improvement has had on freight rates.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied in removing a small shoal west of the Norfolk and Western Railway bridge across the Eastern Branch, and in completing the project by dredging between the Norfolk and Western Railway and Campostella bridges.

For more extended information and maps, see Reports of Chief of Engineers for 1880, page 815; 1885, page 1018; 1887, page 969; and 1893, page 1323. For reference to examinations and surveys, see Report of Chief of Engineers for 1906, page 238.

July 1, 1908, balance unexpended	$3,863.38
Received from sales during fiscal year	3.50
	3,866.88
June 30, 1909, amount expended during fiscal year, for works of improvement	3,863.38
July 1, 1909, balance unexpended	3.50
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*b*) *Hospital Point.*—The land of this point is the property of the United States, and a part of the grounds used by the Navy Department as a site for a hospital. The main channel of Norfolk Harbor passes in front of and close to this point.

The project for this work, adopted in 1902, required the cutting off of 450 feet of the point, the construction of a sea wall and wharf, and the dredging of the area on both sides of the old point. The depth to be secured in the dredging was to be the same as that of the harbor—25 feet at mean low water. The estimated cost of the work was $193,957, all of which has been appropriated.

On June 30, 1909, the expenditures had amounted to $193,957, and had resulted in the completion of the project. Of the amount expended, $6,392.39 was applied toward maintaining the project depth.

During the fiscal year dredging was done over a portion of the shoaled area south of the point.

The amount required in the fiscal year 1911 will be applied to dredging the balance of the shoaled area to the project depth.

The statements in the previous section of this report regarding the character and volume of the commerce affected by the improvement of Norfolk Harbor, and as to the tidal range, state of navigability of the harbor, and the effect of the improvement on freight rates, apply to this section also.

A report upon an examination of this work will be found at page 964, Annual Report of the Chief of Engineers for 1889; and in the report for 1897, page 1335 et seq., full details of the project, with maps explanatory thereof, are given.

July 1, 1908, balance unexpended	$6,392.39
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,392.39
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*c*) *Thirty-foot channel.*—As noted in section (*a*) above, the existing ship channel affords a 28-foot navigation, 450 feet wide, from Hampton Roads to the junction of the Southern and Eastern branches.

Under a project adopted March 2, 1907, the existing ship channel is to be deepened to 30 feet and to be given a width of 600 feet from Hampton Roads to Lambert Point and 800 feet from Lambert Point to the junction of the Eastern and Southern branches of the Elizabeth River. This project also includes the removal of the shoals at the mouth of the Eastern Branch to a depth of 25 feet and a width of 500 feet. The estimated cost of the project is $1,132,000.

The expenditures to June 30, 1909, have amounted to $261,281.62.

The sum of $16.15 has been received from sales.

During the fiscal year dredging was continued under the above-stated project on the sections of the channel between Lambert Point and Craney Island light, and the dredging of the sections between Craney Island light and Bush Bluff light-ship and between Lambert and Pinner points was started. At the close of the fiscal year work was still in progress on all of the above-mentioned sections.

This project is in progress under a continuing-contract authorization, for which the sum of $525,000 still remains to be appropriated.

On June 30, 1909, the project was about 40 per cent completed. The work accomplished consisted in the removal of the shoals at the mouth of the Eastern Branch and the partial excavation of the new

30-foot channel between Pinner Point and Bush Bluff light. Work on the new 30-foot channel has not yet progressed sufficiently to determine its effect upon commerce. Vessels have recently departed at high tide drawing 31 feet.

The statements contained in section (*a*) above regarding the character and volume of commerce, tidal range, and state of navigability of the channel apply to this section also.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied to dredging under the existing project for the purpose of extending the benefits of the improvement.

Reports, with maps, upon examinations of this improvement will be found in House Documents Nos. 373 and 381, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended	$318,234.09
Received from sales during fiscal year	16.15
Amount appropriated by sundry civil act approved March 4, 1909	200,000.00
	518,250.24
June 30, 1909, amount expended during fiscal year, for works of improvement	172,515.71
July 1, 1909, balance unexpended	345,734.53
July 1, 1909, outstanding liabilities	17,169.56
July 1, 1909, balance available	328,564.97
July 1, 1909, amount covered by uncompleted contracts	330,249.78
Amount (estimated) required for completion of existing project	525,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L 1.)

2. *Western branch of Elizabeth River, Virginia.*—The channel of the river, when the project for improvement was adopted, was 12 feet deep at mean low water and from 50 to 300 feet wide.

The project adopted June 3, 1896, provided for obtaining, by dredging, a channel 200 feet wide and 20 feet deep at mean low water for a distance of about 1 mile from deep water in Norfolk Harbor. The estimated cost was $45,000, all of which has been appropriated.

Up to June 30, 1909, the sum of $44,671.65 has been expended on this improvement, the result being the completion of the project.

It is proposed to utilize the available balance in maintaining the improvement.

A draft of 19 feet at mean low water can be carried in the improved channel. The average rise and fall of the tide is 2.7 feet.

This stream is navigable for small sailboats to farms situated about 9 miles from its mouth.

The commerce in the main consists of manufactured lumber, ore, and farm products. For the calendar year 1908 it is reported to have amounted to 1,830,617 tons, valued at $44,892,006.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

For reference to list of reports on examinations of this stream, see Report of the Chief of Engineers for 1906, page 240.

The balance of funds available will be applied to maintaining the channel by dredging.

July 1, 1908, balance unexpended	$328.35
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	5,328.35
June 30, 1909, turned into surplus fund	328.35
July 1, 1909, balance unexpended	5,000.00

(See Appendix L 2.)

3. *Hampton Roads, Virginia.*—Before improvement, vessels of more than 25 feet draft could not reach Newport News on account of the shoal in Hampton Roads, known locally as "Middle Ground bar."

Under an item in the act of June 13, 1902, provision was made for dredging a channel through the Middle Ground bar 500 feet wide and 30 feet deep at mean low water. The estimated cost of the work was $225,000.

Up to June 30, 1909, $228,572.10 had been expended on the work, $3,572 of which was for maintenance. The project had been completed.

During the fiscal year dredging was in progress, and at its close had not been completed. The purpose of this work is to give the section of the channel originally dredged its project depth over the required width, shoaling having occurred on the easterly side of its northern end.

On June 30, 1909, vessels of 30 feet draft could navigate the channel safely. The average tidal range is 2.5 feet.

The head of navigation via this channel is at Richmond, Va., on the James River, a distance of about 105 miles up the river.

The amount of commerce when the improvement was undertaken in 1902 amounted to 2,663,669 tons. For the calendar year 1908 it is reported to have amounted to 6,354,774 tons, valued at $432,472,181. The bulk of the tonnage is in coal and grain.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

It is proposed to expend, under an existing contract, the available balance in maintaining the project depth and width of channel for the purpose of keeping the improvement available.

For reference as to reports on examinations and surveys, see Report of the Chief of Engineers for 1906, page 240.

July 1, 1908, balance unexpended	$12,416.09
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,488.19
July 1, 1909, balance unexpended	8,927.90
July 1, 1909, outstanding liabilities	2,508.42
July 1, 1909, balance available	6,419.48
July 1, 1909, amount covered by uncompleted contracts	4,234.95

(See Appendix L 3.)

4. Nansemond River, Virginia.—The original channel of this stream permitted it to be navigated at mean low water by vessels drawing not more than 5 feet. The depth was increased to 8 feet at the same stage of tide under appropriations made between 1873 and 1878 at a cost of $37,000.

The project under which the work has been carried on until recently was adopted August 11, 1888, and called for a channel 100 feet wide from Suffolk, the head of navigation, to the Western Branch, while from the latter place to Town Point its width was to vary from 200 to 400 feet. The depth to be obtained throughout was 12 feet at mean low water. This improvement was estimated to cost $152,500.

At present it is contemplated to provide a channel only 80 feet wide and 12 feet deep at mean low water between Suffolk and Town Point, which is now deemed ample for the commerce of the stream.

Up to June 30, 1909, the expenditures under the project of 1888 and its modification have amounted to $54,767.71, of which amount $14,090.60 has been applied to maintenance. The channel between Suffolk and the Western Branch has been dredged to 80 feet in width and 12 feet in depth at mean low water, and a turning basin has been excavated at the former place. The project is about 67 per cent completed.

Work on maintaining the channel in the vicinity of the mouth of the Western Branch was done under a contract for dredging in that section of the river during the fiscal year.

At the close of the fiscal year a boat drawing 11 feet at mean low water could reach Suffolk, the head of navigation, 18 miles above the mouth of the river. The tidal variations are about 3 feet at Town Point and 3.8 feet at Suffolk.

The commerce of the stream consists principally of lumber, agricultural products, and merchandise. In 1890 it is reported to have reached about 220,000 tons. For the calendar year 1908 it is reported to have amounted to 132,292 tons, valued at $3,651,525.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

The small balance unexpended and the amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied toward maintaining the improvement.

For reference to list of reports of examinations and surveys, see Report of Chief of Engineers for 1906, page 241.

July 1, 1908, balance unexpended	$5,039.84
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,807.55
July 1, 1909, balance unexpended	232.29
Amount (estimated) required for completion of existing project	10,269.50
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix L 4.)

5. Pagan River, Virginia.—Originally the shoals in this stream limited the draft of vessels to 6½ feet at mean low water. Under a project adopted in 1880 the sum of $10,000 was expended in dredging a channel 60 feet wide and 8 feet deep at mean low water through three shoals between the mouth and Smithfield, Va.

The project upon which was based the appropriation of $10,870 in the act of June 13, 1902, provided for obtaining a channel from Smithfield to the mouth of the river 80 feet wide and 8 feet deep at mean low water. The estimated cost was $28,870. This project was modified by the act of March 3, 1905, which authorized the expenditure of the balance remaining of the appropriation of 1902 in securing a channel not less than 40 feet wide and of such depth as might be obtained without exceeding said balance. In the project submitted under the above-cited provision of law it was stated that the unexpended balance would provide such a channel 10 feet in depth at mean low water.

Up to June 30, 1909, the expenditures had amounted to $10,671.01, and the project had been completed.

There is now a navigable channel 40 feet wide and 10 feet in depth at mean low water from the mouth of the river for a distance of about 9 miles to Smithfield, the head of navigation. The average range of the tide is 2.6 feet.

The commerce is handled by numerous small schooners and sloops and two regular steamers, and consists largely of peanuts and oysters.

The commerce of this stream has averaged about 100,000 tons a year, but has varied considerably from year to year, according to whether conditions have or have not been favorable to the production of peanuts and oysters. For the calendar year 1908 it is reported to have amounted to 84,108 tons, valued at $14,100,400.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

Reports upon examinations and surveys of this river will be found in the Annual Report of the Chief of Engineers for 1875, Part 2, page 156, and for 1901, page 1174; also in House Document No. 397, Sixtieth Congress, first session.

July 1, 1908, balance unexpended	$198.99
June 30, 1909, amount covered into surplus fund	198.99

(See Appendix L 5.)

6. *Appomattox River, Virginia.*—(*a*) *General improvement.*—The original channel in this river was narrow and tortuous, and numerous shoals prevented vessels drawing more than 6½ feet from navigating it at mean high water.

The original project, which is also the existing project, was adopted in 1871 and revised in 1893. The project as revised covers the attainment and maintenance of a channel 80 feet wide and 12 feet deep at mean high water between Point of Rocks and Petersburg. The cost of providing this channel was estimated at $471,920 and its maintenance at $10,000 annually.

On June 30, 1909, the sum of $465,288.76 had been expended toward the improvement and the sum of $52,434.97 for maintenance.

The amount reported as expended during the fiscal year was applied to improving by dredging the channel between Petersburg and a point about 4½ miles below and in maintaining the channel by removing shoals formed by the freshet of 1908. The project is about completed and future work will be toward maintenance.

At the present time the channel of the river is available at high water for vessels of about 9 feet draft, the normal range of the tide being about 2.6 feet. The head of navigation is Petersburg, Va., about 11 miles from the mouth of the river.

The commerce consists of lumber and miscellaneous products. In 1890 it amounted to about 20,000 tons. It gradually increased until in 1900 and 1901 it amounted to about 150,000 tons. Since then it has decreased, and for the calendar year 1908 it is reported to have been 31,830 tons.

It is proposed to expend the balance now available in removing material brought down by freshets and deposited in the navigable channel of the river. This work is required to render the navigable channel available in the interests of commerce. Work will be commenced early in the next fiscal year, a contract having been awarded for the work.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied toward the removal of material deposited in the navigable channel by freshets, for the purpose of maintaining the improvement.

An examination of this stream was made in 1852, to which reference is made in the Annual Report of the Chief of Engineers for 1870, page 68. A survey was made in 1870 and the report published in the Annual Report of the Chief of Engineers for that year, commencing at page 68. An examination, with plan and estimate, was made in compliance with act of March 2, 1907, and the report will be found in House Document No. 952, Sixtieth Congress, first session.

July 1, 1908, balance unexpended		$49,192.23
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
Amount allotted from appropriation for emergencies in river and harbor works, act of March 2, 1907		10,000.00
		64,192.23
June 30, 1909, amount expended during fiscal year:		
For maintenance of improvement	$43,917.66	
Repaid to appropriation for emergencies in river and harbor works	6,800.00	
		50,717.66
July 1, 1909, balance unexpended		13,474.57
July 1, 1909, outstanding liabilities		3,171.55
July 1, 1909, balance available		10,303.02
July 1, 1909, amount covered by uncompleted contracts		4,633.65
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*b*) *At Petersburg.*—The project for the work contemplated is not to provide a navigable channel, but to excavate a new channel into which to deflect the river, and thus overcome the trouble experienced by the deposit of sediment in the navigable channel of the river in the neighborhood of Petersburg.

The project for this work, which was adopted June 13, 1902, contemplates the excavation to mean low water of a cut from 200 to 300 feet wide and 2½ miles long and the diversion of the river into the said cut by means of a dam built across the present channel at the head of the harbor of Petersburg, and includes the construction of bridges for the highways and railway crossing the new channel and other incidental work. The estimate for the work was $200,000, which amount has been provided.

The river and harbor act of March 3, 1909, authorized a contract for the completion of the diversion work at a cost of $60,000, yet to be appropriated.

At the close of the fiscal year 1909 the sum of $186,199.88 had been expended, all of the land needed has been purchased, the highway and railway bridges have been built, the new cut excavated, except where rock was encountered, and the dam across the Appomattox River built to a height of 9.5 feet above diversion low water. The expenditures during the fiscal year were applied to payment for work done under contract. The project is completed as far as available funds permit.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

The balance of funds will be applied to completing the work under the adopted project, provided funds are appropriated for the additional work of excavating rock and earth, revetting banks, raising levee, and raising height of dam. The amount estimated for maintenance will be applied to repairing and revetting levee.

The commerce to be affected by the improvement contemplated is the same as that mentioned in the preceding section, and all general statements made therein apply equally well to this section.

A report upon an examination and survey will be found in the Annual Report of the Chief of Engineers for 1882, page 907. Another report, with a map, will be found in the Report of the Chief of Engineers for 1889, page 957. Other reports will be found in the Annual Reports of the Chief of Engineers for 1893, page 1345, and for 1901, page 1467.

July 1, 1908, balance unexpended		$64,818.41
June 30, 1909, amount expended during fiscal year, for works of improvement		51,018.29
July 1, 1909, balance unexpended		13,800.12
Amount (estimated) required for completion of existing project		60,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$60,000.00	
For maintenance of improvement	5,000.00	
		65,000.00
Submitted in compliance with requirements of sundry civil act of June, 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix L 6.)

7. *Harbor at Cape Charles City, Va.*—The harbor proper is landlocked and covers an area of 10 acres, and it and the exposed channels leading thereto had, before the beginning of the work, a depth of 12 feet at mean low water.

The project was adopted in 1890 and requires the dredging of a channel through Cherrystone Inlet and bar 100 and 200 feet wide, respectively, and 16 feet deep at mean low water, the dredging of an entrance channel 100 feet wide of the same depth, and dredging over the entire area of the protected and inclosed harbor to a depth of 14 feet at mean low water. Jetties of stone were to be constructed for the protection of the channel leading into the basin. This work was estimated to cost $142,340.

The expenditures to June 30, 1909, amounted to $119,033.71, and resulted in the dredging and redredging of one-half of the inner harbor to the proper depth and the excavation of channels of the required dimensions through the inlet and the entrance to the basin and the construction of 875 feet of the north jetty and 232 feet of the south jetty. The north jetty is 1,625 feet in length, but 750 feet of this was built without expense to the United States. Of the amount expended, $13,360.16 was applied to maintenance. The project is about 85 per cent completed.

On June 30, 1909, a vessel drawing 12 feet could enter the harbor at mean low water. The docks within the landlocked harbor are about 3 miles from the 16-foot contour in Chesapeake Bay at Cherrystone bar. The range of the tide is about 2.5 feet.

The commerce consists mainly of miscellaneous freight, agricultural products, fertilizer, and some oysters and fish. At the beginning of the improvement the annual commerce was about 400,000 tons. For the calendar year 1908 it is reported to have amounted to 1,811,731 tons, valued at $45,293,275. It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

The available balance and amounts estimated for will be applied to dredging under the adopted project, and in maintaining the improvement for the benefit of existing commerce.

For more extended information, see Annual Report of the Chief of Engineers for 1890, page 975.

July 1, 1908, balance unexpended		$30,401.11
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11,074.66	
For maintenance of improvement	13,360.16	
		24,434.82
July 1, 1909, balance unexpended		5,966.29
Amount (estimated) required for completion of existing project		30,700.16
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix L 7.)

8. *Waterway from Norfolk, Va., to the sounds of North Carolina.*—This waterway extends from Norfolk, Va., via the Southern Branch of the Elizabeth River to Deep Creek, thence through the Dismal Swamp Canal to South Mills, N. C., and from the latter point through Turners Cut to the Pasquotank River, to Albemarle Sound, and thence to Pamlico Sound by Croatan Sound.

The draft which could be carried through this waterway at the time of the adoption of the project for improvement was limited to

2½ feet at mean low water, owing to the deterioration of the Dismal Swamp Canal, which originally had had a depth of about 6 feet.

The project, adopted March 3, 1899, provides for the dredging of channels in Deep Creek, Turners Cut, through a shoal in the Pasquotank River near Ship Yard bar, and through a bar in Croatan Sound near Croatan light. All these channels, except the last named, were to be 100 feet wide and 10 feet deep at mean low water. The Croatan channel was to be 200 feet wide and 12 feet deep at mean low water. For the protection of these channels sheet piling was to be driven where necessary. The estimated cost of this work was $274,310.

Up to June 30, 1909, the sum of $251,196.46 had been expended on the project and $9,090.91 on its maintenance. The project has been completed, and the additional work required is for maintenance.

The amount reported as expended during the fiscal year for maintenance was applied toward expenses of inspections of the water route made from time to time, dredging in Deep Creek, Virginia, and removing sunken obstructions in the Pasquotank River, North Carolina.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied toward removal of obstructions and toward dredging for the purpose of maintaining the improvement.

On June 30, 1909, vessels drawing 10 feet of water can at mean low water navigate through all sections of the route which have been improved by the United States. The canal which extends from Deep Creek to South Mills, is maintained at the expense of a private corporation, which tries to keep it available for vessels of 10 feet draft, but on June 30, 1908, the limiting depth for the entire route was only 9 feet, owing to the existence of shoal places in the canal. Deep Creek is the only tidal portion of the improvement, and there the rise and fall averages 3 feet. In the other sections the water level changes according to the direction and velocity of the wind. The route is about 67 miles in length.

The commerce for the calendar year 1908 is reported to have amounted to 319,573 tons, valued at $5,613,700. The main items of commerce are coal, fertilizer, timber, and farm products.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

For list of reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 246.

July 1, 1908, balance unexpended	$4,820.40
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,237.77
July 1, 1909, balance unexpended	2,582.63
July 1, 1909, outstanding liabilities	1,107.22
July 1, 1909, balance available	1,475.41
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix L 8.)

9. Inland water route from Norfolk, Va., to Albemarle Sound, North Carolina, through Currituck Sound.—This route extends from Norfolk, Va., to Albemarle Sound, via the Southern Branch of the Elizabeth River, Albemarle and Chesapeake Canal, North Landing River, Currituck Sound, Coanjock Bay, North Carolina Cut, and North River. The canal and cut mentioned are now controlled by a pivate corporation.

This route had originally a good 5-foot mean low-water channel, but navigation was obstructed by snags, sunken logs, and overhanging trees. Sharp bends added to the other difficulties of navigation.

Until the act of September 19, 1890, the work of improvement was carried on under several separate projects, upon which a total of $240,169.69 had been expended. By that act all these projects were consolidated.

The present project, adopted September 19, 1890, provides for obtaining a channel 80 feet wide and 9 feet deep at mean low water through the whole extent of the waterway to be improved by the United States, at an estimated cost of $306,667.08, including the previous expenditures above mentioned. The project is considered as complete, the additional work required being for maintenance. Since September 19, 1890, and up to June 30, 1909, the sum of $61,987.64 has been expended upon this improvement and $33,234.30 upon maintenance.

The expenditures during the fiscal year were applied to maintenance.

The work consisted in keeping the waterway clear of sunken obstructions.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1911, will be applied in maintaining the improvement by keeping the various channels clear of logs, snags, and similar obstructions, and in redredging parts of the channel through Currituck Sound where these have deteriorated.

The channels through the various portions of the route are now from 60 to 80 feet wide and have a depth of 9 feet at mean low water. The draft of vessels which can pass through the route at mean low water on June 30, 1909, is 9 feet. The route is about 67 miles long.

There is no lunar tide in any portion of the route, except in the Southern Branch of the Elizabeth River, where the average rise and fall is 2.7 feet. In the other sections the water level varies according to the velocity and direction of the wind, for which an allowance of 0.5 foot is made, but severe storms may cause an elevation or depression of 2 feet or more.

The commerce has varied considerably since the route was opened to navigation. The highest reported was for the calendar year 1890, when it amounted to 403,111 tons. Since that time it has decreased considerably, and for the calendar year 1908 it amounted to 133,081 tons; value not known. The principal items of shipment consist of coal, fertilizer, and timber products.

The gradual decrease in the commerce of the route is due to the depletion of the forests and the consequent decrease in timber shipments.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

Considerable difficulty is experienced in keeping this waterway free from obstructions by logs dropped from rafts due to the improper construction of the rafts, and, in the absence of any adequate laws permitting the Engineer Department to control the construction of rafts, it has been found impossible to prevent the frequent occurrence of these obstructions.

For references as to examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 247.

July 1, 1908, balance unexpended	$1,827.16
Amount allotted from appropriation by river and harbor act approved March 3, 1909	1,500.00
	3,327.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,478.10
July 1, 1909, balance unexpended	1,849.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix L 9.)

10. Perquimans River, North Carolina.—Before work was begun navigation was obstructed by numerous stumps just below the town of Hertford, N. C., which limited the draft of vessels to 7 feet.

The first appropriation for the Perquimans River was made in 1876, and was based on a project to provide a channel 200 feet wide with a depth of 9½ feet at mean low water through a stumpy reach near Hertford, N. C., and the amount provided ($2,500) was expended in obtaining said channel, which was completed in 1877.

The existing project, adopted by Congress March 3, 1905, was to provide a channel 200 feet wide and 9 feet deep at mean low water through the stumpy reach about 800 feet below Hertford, N. C., at an estimated cost of $11,250.

To June 30, 1909, $11,168.06 had been expended, and all the work contemplated has been completed.

On June 30, 1909, vessels drawing 9 feet can, at mean low water, reach the town of Hertford.

There is no lunar tide in the river, the level of the surface of the water varying according to the direction and velocity of the wind. The average difference in elevation is about one-half foot, but storms may cause a difference of as much as 2 feet or more. The head of navigation is at Newby's bridge, about 26 miles from the mouth of the river.

An estimate in 1902 placed the commerce at about 36,000 tons, and for the calendar year 1908 it is reported to have amounted to 13,100 tons, valued at $660,000. The principal items of freight transported were lumber, logs, fertilizer, and cotton seed.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

July 1, 1908, balance unexpended	$81.94
July 1, 1909, balance unexpended	81.94

(See Appendix L 10.)

11. Blackwater River, Virginia.—In its original condition this stream afforded a natural channel of 7 feet depth, but navigation was difficult owing to the existence of obstructions and sharp bends.

Between 1878 and 1882 Congress appropriated a total of $14,000 for the improvement of the stream, to consist of the removal of logs, snags, overhanging trees, and the removal of sharp bends. Operations ceased in 1884, from which time no work was done upon the river to 1908.

The existing project was adopted March 2, 1907, and provides for the clearing of the stream of the existing obstructions so as to afford a condition of easy navigation. The estimated cost of the project is $8,000, all of which has been appropriated.

To June 30, 1909, there had been expended $2,144.33 on the existing project, which is completed, and $988.26 has been expended for maintenance. During the fiscal year work was confined to maintenance in removing sunken obstructions. The available balance will be expended in maintaining the improvement as may be found necessary from time to time.

The sum of $15 has been received from sales.

On June 30, 1909, vessels drawing 7 feet can navigate the river. The river is a tideless stream, and the only fluctuations in the water level are those due to freshets, which usually do not exceed 3 to 4 feet. The river is navigable from the railroad bridge at Franklin, Va., to its mouth, a distance of about 13 miles.

During the calendar year 1908 the commerce amounted to 5,390 tons, valued at $862,400. The principal items consisted of agricultural products, timber, and fertilizer.

It is impracticable to state what effect, if any, has been made by the improvement upon freight rates.

For more extended information, see Report of the Chief of Engineers for 1875, part 2, page 161, and report of an examination printed in House Document No. 177, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended	$5,855.67
Received from sales during fiscal year	15.00
	5,870.67
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	988.26
July 1, 1909, balance unexpended	4,882.41
July 1, 1909, outstanding liabilities	23.40
July 1, 1909, balance available	4,859.01

(See Appendix L 11.)

12. Meherrin River, North Carolina.—In its original condition this stream afforded a navigable channel about 80 feet wide and 7 feet deep from its mouth to the town of Murfreesboro, N. C. The channel was tortuous and badly obstructed by logs, overhanging trees, and a few shoals.

In the year 1882 Congress appropriated $5,000 toward the improvement of the river, the improvement to consist in the removal of the obstructions to navigation, and operations were carried on from time to time in the years 1883 to 1886, inclusive. The total expenditure amounted to $4,584.53.

The existing project was adopted by Congress March 2, 1907. It provides for the removal of existing obstructions in the nature of sunken logs, overhanging trees, and a few shoals, so as to render navigation easy. The estimated cost of the project is $6,000, all of which has been appropriated.

To June 30, 1909, there had been expended on the existing project $1,932.88, which is completed. The sum expended for maintenance is $1,412.42. During the present fiscal year the maintenance work was confined to the removal of sunken obstructions. It is proposed to expend the available balance in maintaining the improvement as may be found necessary from time to time.

The sum of $10 has been received from sales.

On June 30, 1909, the maximum draft that could be carried with safety was 7 feet. The river is a tideless stream, but freshets cause variations in the water level of 3 to 4 feet. The head of navigation is at Murfreesboro, 11 miles above the mouth of the river.

During the calendar year 1908 the commerce of the river aggregated 8,690 tons, valued at $1,086,700. The principal items of shipment are timber products and general merchandise.

It is impracticable to state what effect, if any, the improvement has had on freight rates.

For more extended information, see Report of the Chief of Engineers for 1882, page 1114, and report of examination printed in House Document No. 137, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended	$4,067.12
Received from sales during fiscal year	10.00
	4,077.12
June 30, 1909, amount expended during fiscal year for maintenance of improvement	1,412.42
July 1, balance unexpended	2,664.70

(See Appendix L 12.)

13. Roanoke River, North Carolina.—Originally the navigable channel to Indian Highland bar, 67 miles above the mouth, was 10 feet deep at mean low water, and thence to the town of Weldon, which is 129 miles from the mouth, the minimum depth was 2½ feet at the same stage.

The project, adopted in 1871, contemplates a channel with a least width of 50 feet from Hamilton to Weldon, 5 feet deep at mean low water, and the removal in the lower portion of the river, below the former point, of such obstructions as may be necessary to accommodate vessels navigating North Carolina sounds. The estimated cost of the work was $269,000.

The expenditures to June 30, 1909, amounted to $240,005.42, of which amount $11,315.19 has been expended in maintenance and $1,355 was received from sales. The project is about 80 per cent completed. The channel obstructions have been removed, and a channel depth of 4 feet at mean low water over the projected width has been provided between Hamilton and Weldon. On June 30, 1908, vessels drawing 8½ feet could go as far as Hamilton, and beyond that point, to within a short distance of Weldon, 4 feet could be carried at mean low water. A bar is forming at the mouth of the river, due to deposits brought down by freshets, and this has somewhat diminished the depth that could otherwise be carried to Hamilton. The upper river is subject to heavy freshets, which cause the only variation in the level of the water surface. Weldon, situated about 129 miles from the mouth, is the head of navigation.

The only work done during the fiscal year was in the nature of maintenance and consisted in the removal of sunken and overhead obstructions.

The commerce has varied considerably since the improvement was undertaken, the maximum amount of freight transported having been in 1891, when it was 376,181 tons. Since then it has decreased, and for the calendar year 1908 it was reported at 78,775 tons, valued at $1,402,080. The principal item of shipment is timber.

The depletion of the forests and the development of railroads in the territory tributary to the river have served to reduce the volume of water-borne freight in recent years.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

The balance available and the amount estimated for will be applied in maintaining the improvement by keeping the channel clear of logs, snags, and similar obstructions.

For reference to reports of examinations and surveys, see Report of the Chief of Engineers for 1906, page 249.

July 1, 1908, balance unexpended	$3,962.48
Received from sales during fiscal year	3.25
	3,965.73
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,616.15
July 1, 1909, balance unexpended	2,349.58
Amount (estimated) required for completion of existing project	41,925.88
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L 13.)

14. Removing sunken vessels or craft obstructing or endangeringnavigation—(*a*) *Wreck of Haze.*—This sloop sunk in James River, Virginia, about 1 mile northeast by north from Nansemond River light. Its removal was authorized July 14, 1908. The wreck was removed during the month of July, 1908, by private parties free of expense to the United States.

(*b*) *Logs, Mackey Creek, North Carolina.*—These logs sunk in the cut approaching Mackey Creek, North Carolina. Their removal was authorized January 27, 1909. The logs were removed during the month of February, 1909, at a cost of $252.62.

(*c*) *Wreck of Bismarck.*—This schooner sunk in Hampton Roads, Virginia, about 1 mile from Pig Point light-house. Its removal was authorized April 15, 1909. The wreck was removed during the month of April, 1909, at a cost of $250.

(See Appendix L 14.)

EXAMINATION MADE IN COMPLIANCE WITH THE RIVER AND HARBOR ACT APPROVED MARCH 3, 1909.

Report dated May 12, 1909, on preliminary examination of *Point Harbor channel, North Carolina,* required by the river and harbor act of March 3, 1909, was duly submitted by the district officer. It was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and was transmitted to Congress and printed in House Document No. 78, Sixty-first Congress, first session. The locality is not considered worthy of improvement by the General Government.

IMPROVEMENT OF RIVERS AND HARBORS IN THE WILMINGTON, NORTH CAROLINA, DISTRICT.

This district was in the charge of Capt. Earl I. Brown, Corps of Engineers. Division engineer, Col. Dan C. Kingman, Corps of Engineers.

1. *Scuppernong River, North Carolina.*—From the mouth to Columbia is 5 miles; to Spruill's bridge, 23 miles.

Before work was commenced on the river there was only about 5 feet across the bar at its mouth. The upper portion was obstructed by logs, snags, stumps, overhanging growth, and abrupt bends, permitting navigation by small vessels only.

The original project, adopted in 1876, was to dredge the bar, make cut-offs at sharp bends, and remove obstructions so as to obtain a channel 60 feet wide and 9 feet deep at low water up to Spruill's bridge.

The present project, adopted by act of June 13, 1902, provides for dredging a channel 3,400 feet long, 150 feet wide, and 9 feet deep at mean low water across the bar at the mouth of the river, at a cost of $14,000.

The project is about 70 per cent completed.

Expended prior to 1902 on previous project		$8,000.00
Expended on present project up to June 30, 1909:		
For improvement	$11,500.00	
For maintenance	4,001.32	
		15,501.32
Total		23,501.32

There was no work done during the fiscal year 1909. The expenditures, $31.35, were for outstanding liabilities of the previous fiscal year and for travel expenses incurred in an examination of a bridge at Columbia.

At the close of the fiscal year 1909, the conditions so far as known are a channel 9 feet deep at mean low water, 90 feet wide for 2,700 feet of its length, and 130 feet wide for 700 feet of its length across the bar at the mouth of the river; thence to Cross Landing, 14 miles above, a good open channel of 7 feet at mean low water, free from obstacles; thence to Spruill's bridge, 9 miles farther, 7 feet at mean low water, but the river in many places is narrow and crooked and obstructed by overhanging trees on the banks and by logs and snags in the channel.

It is proposed to apply the available balance, together with $2,500 allotted from act of March 3, 1909, for preservation and maintenance of rivers and harbors and the additional appropriation recommended to the completion of the project and to maintenance.

This is a nontidal stream with no slope, the oscillations of the surface being controlled by the winds.

Spruill's bridge, 23 miles from its mouth, is the head of navigation, to which point 7 feet can be carried at mean low water.

The commerce for 1908 amounted to 12,515 tons, valued at approximately $215,200, a decrease of 56,115 tons below last year. The principal falling off was caused by the completion of the Norfolk and Southern Railway to Columbia and the discontinuance of the steamboat line between Columbia and Edenton.

July 1,1908, balance unexpended	$1, 530. 03
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2, 500. 00
	4, 030. 03
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	31. 35
July 1, 1909, balance unexpended	3, 998. 68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M 1.)

2. *Fishing Creek, North Carolina.*—When improvement began the stream was badly obstructed by masses of fallen timber, overhanging trees on banks, logs and snags in channel, and was navigable by rafts only a few miles above the mouth.

The original project of 1889 was to clear the stream of logs, snags, trees, etc., up to Bellamy's mill. It was amended in 1896 to limit the work to that part below the Wilmington and Weldon Railroad bridge, and this amended project was completed in 1901. The sum of $22,715.10 was spent on this project, which has been finished.

Amount expended on present project up to June 30, 1909, for maintenance, $2,534.90.

The lower 6 miles of the stream was cleared of obstructions in 1909.

It is not navigable above Beech Swamp on account of its tortuous course and rapid current. Below that point it is navigable during the higher stages about eight months annually.

The stream is reported by those interested in its navigation to be in poor condition to Beech Swamp, being badly obstructed by fallen trees, logs, and snags. Between Beech Swamp and the railroad bridge the condition of the stream is unknown, but it is presumably bad. The owners of the vessels navigating this stream report that there are so many obstructions that it is unsafe to navigate unless the water is at least 2 feet higher than the stages at which it was safe to navigate just after the stream had been cleared out.

The present head of navigation is Beech Swamp, 17.5 miles from its mouth, to which about 2 feet can be carried during about three months of the year.

The water surface varies from a minimum depth of 6 inches at low water to 10 feet during the high freshet stages.

The commerce for 1908 amounted to 1,694 tons, valued at $29,851, showing a gain over that for 1907 of 203 tons. It consisted principally of cotton seed, cotton-seed meal, fertilizers, timber, etc.

The effect of the improvement on railroad and boat rates can not be definitely stated; but the stream when opened to navigation affords an outlet to farm products, timber, lumber, etc., which have no other outlet except by wagons.

References: Annual Reports for 1890, page 1179; 1893, page 1377; 1900, page 1796; 1905, page 1203.

It is proposed to apply the appropriation recommended to the maintenance of the natural channel as far as Beech Swamp.

July 1, 1908, balance unexpended	$347.12
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	347.12
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	1,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M 2.)

3. Pamlico and Tar rivers, North Carolina.—(One river, called the Pamlico below Washington, N. C., and the Tar above that point.) Distance from Washington to Greenville, 22 miles; to Tarboro, 49 miles; to Fishing Creek, 56 miles; to Little Falls, 88 miles; to Rocky Mount, 89 miles.

Prior to its improvement, which was begun in 1876, the Pamlico River (that portion of the stream below Washington) was obstructed by war blockades, sunken logs, snags, stumps, and sand shoals.

The governing low-water depths were 5 feet to Washington and perhaps 1 foot to Tarboro, the navigation to which place was practicable during freshet stages only. About 3 feet could be carried to Tarboro during about eight high-water months per year.

The original project for the improvement of the river below Washington was that submitted in December, 1875 (Annual Report of the Chief of Engineers for 1876, p. 361), and adopted by Congress August 14, 1876, and had for its object to provide 9 feet at low water, from Washington to its mouth, by dredging and the removal of piles and obstructions at an estimated cost of $28,050. In the project proper the proposed draft to be provided was not specified, but work under the project was devoted to securing 9 feet at mean low water. Under this project the sum of $18,000 was appropriated, of which $17,877.12 was expended; the remainder, $122.88, was transferred to the improvement of the Pamlico and Tar rivers, when the improvements were combined in 1880.

The Tar River (that portion of the stream above Washington), prior to improvement, was obstructed by sunken logs, piles, wrecks, stumps, snags, and trees in the channel, and overhanging trees along its banks. The original project for this portion of the stream was that of 1879 (Annual Report of the Chief of Engineers for 1879, p. 700) for the removal of obstructions between Washington and

Tarboro at an estimated cost of $10,000. An appropriation of $3,000 was made for this purpose in 1879, of which $2,867.27 was expended, leaving a balance of $132.73, which was transferred to the joint improvement.

In 1889 the project was extended to clear the natural channel above Tarboro, 34 miles, to Little Falls, and the estimate was increased $16,200, making the total estimate $92,200.

The present project is that of 1875 (for Pamlico River), and of 1879, 1889, and 1907 (for Tar River), somewhat modified to secure a channel 100 feet wide and 9 feet deep at mean low water to Washington; thence a channel 60 feet wide and 4 feet deep at low water for 22 miles farther, to Greenville; thence a channel 60 feet wide and 20 inches deep at low water for 26 miles farther, to Tarboro; thence to keep clear of obstructions the natural channel 34 miles farther, to Little Falls, 2 miles below Rocky Mount, N. C.

The project as modified by act of March 2, 1907, changed the depth between Washington and Greenville from 3 to 4 feet at mean low water, at an estimated cost of $3,800.

The work for the year was for maintenance and consisted in removing the worst obstructions from the channel between Washington and the mouth of Fishing Creek, and making surveys of the shoals immediately below Greenville, and also in the vicinity of the Norfolk and Southern Railway bridge at Washington.

Expended prior to 1876 on previous projects		$15,000.00
Expended on present project to June 30, 1909:		
For improvement	$149,875.83	
For maintenance	23,485.42	
		173,360.75
Total		188,360.75

The project of 1875, with its various modifications, is completed, and at the beginning of the fiscal year there was a channel to Washington 100 feet wide and 9 feet deep at mean low water; thence to Greenville a channel 60 feet wide and 4 feet deep at low water, which is in good condition except for a small amount of snagging required. The dredged cuts below and above Washington have slightly deteriorated during the year.

Above Greenville the river has deteriorated for lack of maintenance and is navigable only during freshet stages of variable duration, extending over six or eight months of the year.

It is proposed to apply the available balance, together with the appropriation recommended, to maintenance of the improvement, both above and below Washington.

The stream is nontidal. Below Washington the only surface variations of importance are due to the wind, with an extreme range of 3 feet under normal conditions. Long protracted easterly or westerly winds sometimes cause variations of 7 or 8 feet. The variations of the upper portion of the river are affected by freshets only.

The head of navigation is Dunbar's bridge, 108 miles from the mouth.

The commerce for the year 1908 amounted to 353,429 tons, valued at approximately $7,909,369 (a decrease as compared with 1907 of

74,959 tons). It consisted principally of cotton, cotton-seed products, grain, potatoes, wood, timber, lumber, fertilizer, and general merchandise.

The tendency of the improvement is to keep down freight rates.

References: History and maps, Annual Reports, 1890, page 1114; 1891, page 1347; 1896, pages 161 and 1101, and 1907, page 267.

July 1, 1908, balance unexpended	$1,542.40
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
Amount received as rent during fiscal year	125.00
	6,667.40
June 30, 1909, amount expended during fiscal year for maintenance of improvement	1,667.40
July 1, 1909, balance unexpended	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911 for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See appendix M 3.)

4. *Contentnia Creek, North Carolina.*—Distance from the mouth to Snow Hill, 31½ miles; Speights bridge, 50½ miles; Stantonsburg, 63 miles.

Previous to improvement this stream was obstructed throughout its entire length by fallen timber, sand shoals, and overhanging growth, and was navigable for shallow-draft craft during only the higher freshet stages of about three to six months of the year.

The original project of 1881 was to clear the stream of these obstructions, so as to obtain from its mouth to Stantonsburg, 63 miles, a depth of not less than 3 feet during the higher stages, about nine months of the year, at a cost estimated in 1888 at $77,500.

The project of 1881 as extended in 1894 included maintenance below Snow Hill, and was again extended in 1899 to include maintenance from Stantonsburg to the mouth. The project has been completed, and additional work required is for maintenance.

Amount expended up to June 30, 1909:	
For improvement	$64,394.56
For maintenance	10,096.33
Total	74,490.89

The work of the year consisted of maintenance by snagging between the mouth of the creek and the twenty-fourth mile post and between the thirty-fifth and forth-second mile posts.

At the close of the fiscal year the creek between its mouth and Snow Hill was in fair condition and could be navigated during six months of the year by boats drawing 3 to 4 feet, depending upon the rainfall. Snow Hill, 31½ miles from its mouth, is practically the head of navigation, although during the higher stages of water boats can ascend the stream to Speights bridge, 50½ miles from its mouth.

The portion of the stream between Snow Hill and Fools Bridge, 10½ miles above, is now being resnagged, the upper 7 miles having been completed, and the remaining 3½ miles will be completed with funds now in hand.

The stream is subject to freshets rising 15 feet above low water at Snow Hill and Stantonsburg.

The commerce for the year 1908 amounted to 18,800 tons, valued at approximately $516,712. It consisted principally of cotton, cotton-seed meal, timber, lumber, fertilizer, general merchandise, etc.

The effect of the improvement on railroad and boat rates can not be definitely stated, but the stream when opened to navigation affords an outlet to farm products, timber, lumber, etc., which have no other outlet except by wagon.

It is proposed to apply the available balance and the appropriation recommended to maintenance below Speights bridge.

References: Annual Reports, 1881, page 1009; 1890, page 1118; 1896, page 1103.

July 1, 1908, balance unexpended	$1,713.46
Amount received as rent during fiscal year	125.00
	1,838.46
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,027.35
July 1; 1909, balance unexpended	811.11
July 1, 1909, outstanding liabilities	361.91
July 1, 1909, balance available	449.20
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M 4.)

5. Neuse and Trent rivers, North Carolina.—(*a*) *Neuse River.*—Distance from Newbern to Contentnia Creek, 32 miles; to Kinston, 50 miles; to Whitehall, 74 miles; to Goldsboro (Wilmington and Weldon Railroad bridge), 94 miles; to Smithfield, 150 miles.

There is considerable uncertainty as to the conditions existing prior to 1878, when improvement by the Government was begun. Before the civil war, and probably for some time afterwards, light-draft steamers made more or less regular trips as high up as Smithfield, but the low-water depth probably did not exceed 2 feet, and the stream was obstructed by snags and after the civil war by war blockades. (See Annual Report of the Chief of Engineers for 1905, p. 240.)

The original project of 1871, as extended in 1878–79 and 1880 and continued to date, provides for an 8-foot navigation up to Newbern during the entire year, 4 feet to Kinston, and during nine months of the year 3 feet to Smithfield, by the removal of war obstructions, dredging, jettying, and snagging, at a total estimated cost of $374,000; extended in 1902 to include dredging a channel 300 feet wide below Newbern and 200 feet wide at Newbern, to a depth of 8 feet at dead low water, in accordance with report and estimate printed in Annual Report of the Chief of Engineers for 1905, page 1427, at an estimated additional cost of $59,081.25. Since its adoption this additional estimate has been reduced to $24,000.

In 1902 the improvement of this river was combined with that of the Trent.

Amount expended on foregoing projects to June 30, 1909:

For improvement	$331,144.77
For maintenance	23,107.69
Total	354,252.46

The expenditures for the year were $8,106.94, of which $3,721.10 was for maintenance, which consisted of snagging between Newbern and Seven Springs, and $4,385.84 was for improvement, which consisted of dredging at Union Point shoal, and at a shoal in the western channel, about 2 miles above Newbern.

As a result of the expenditures to date the channel at and below Newbern has been completed to project width and depth, all war blockades have been cleared away, and the natural channel has been cleared to Smithfield, 150 miles above Newbern. No attempt has been made to maintain the stream above Waynesboro Landing (Goldsboro), 98½ miles above Newbern. At low water 8 feet can be carried to Newbern, 4 feet to Village Creek, 25 miles above, 2.5 feet to the mouth of Contentnia Creek, 31½ miles above Newbern, and 1 foot to Kinston, 50 miles above Newbern, above which point the river is not navigable on stages of less than 2 to 3 feet.

A channel known as the "Western channel," immediately above Newbern, has been cleared to a depth of 4 feet at mean low water, and is now being dredged to a depth of 4 feet at dead low water.

The channel of the river between Newbern and Seven Springs, near Whitehall, is in good condition.

The practical head of navigation is Waynesboro Landing, about 136 miles from the mouth of the river.

The stream is nontidal. The variation of the water surface below Newbern is due entirely to the influences of the wind. The maximum range is 3.3 feet during severe northwest winds to 8½ feet during violent northeast gales. The upper river is subject to freshets, which rise 17 feet at Smithfield, 18 feet at Waynesboro Landing, and 20 feet at Kinston.

The funds on hand are to be used for maintenance and in securing the project depth of 4 feet between Newbern and Kinston by dredging.

It is not considered practicable to carry out the project above Newbern as it now stands for any reasonable amount of money, but the appropraition recommended will be applied toward securing 4 feet to the mouth of Contentnia Creek and 2 feet thence to Kinston by jetties, training walls, and dredging where necessary, and toward maintenance of the improvement.

The commerce of the year amounted to 384,418 tons, valued at $7,083,720. It consisted of grain, timber, lumber, fertilizers, general merchandise, etc. One of the causes of the falling off of the commerce is the discontinuance of the line of steamers between Newbern and Belhaven.

Freight rates are materially lessened by reason of the improvement.

References: See Annual Reports of 1879, page 71; 1900, pages 268 and 1802; 1901, page 1545.

July 1, 1908, balance unexpended		$11,718.48
Amount received as rent during fiscal year		250.00
		11,968.48
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$4,385.84	
For maintenance of improvement	3,721.10	
		8,106.94
July 1, 1909, balance unexpended		3,861.54
July 1, 1909, outstanding liabilities		1,662.80
July 1, 1909, balance available		2,198.74
Amount (estimated) required for completion of existing project		72,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		(a)

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*b*) *Trent River.*—Distance from the mouth at Newbern to Pollocksville, 18 miles; to lower Quaker bridge, 27 miles; to Trenton, 38 miles. Its original condition was a channel of 6 feet depth to Pollocksville, and the stream was fairly clear to lower Quaker bridge, above which point it was badly obstructed.

The original project of 1879 (see Annual Report of the Chief of Engineers for 1879, p. 711) was to secure 3 feet depth at low water to Trenton; extended in 1886 to obtain 8 feet depth through Foys flats; extended in 1889 to clear out obstructions to upper Quaker bridge, 40 miles above Trenton. The sum of $64,262.64 was expended on this project and its modifications.

In 1896 the project of 1879 was amended to provide for the maintenance of a channel only 30 feet wide and 3 feet deep from Newbern to Trenton, at an annual estimated cost of $2,500. This was extended in 1902 to include dredging at Newbern to 8 feet depth at dead low water from harbor line to channel, at an estimated cost of $24,000 additional. The existing project, therefore, is to dredge to 8 feet dead low water at Newbern and maintain a channel 30 feet wide and 3 feet deep at low water to Trenton. In 1902 the improvement of this river was combined with that of the Neuse. This project has been completed.

By joint resolution approved March 4, 1907, authority was given to expend such portion of the appropriation made in river and harbor act of March 2, 1907, as may be necessary for securing a channel 6 feet deep over Foys flats in the Trent River, about 4 miles above Newbern. This work has been done.

Amount expended on existing project up to June 30, 1909:	
For improvement	$25,817.78
For maintenance	18,378.61
Total	44,196.39

---

[a] See consolidated money statement on page 298.

The expenditures for the year were $5,205.64, of which $2,079.17 was for improvement and $3,126.47 for maintenance.

The work of the year resulted in obtaining a depth of 6 feet at dead low water over Foys flats, as outlined in joint resolution approved March 4, 1907, and in maintaining the channel between Newbern and Trenton. The project is completed, except for maintenance.

The improvement above Trenton has been abandoned.

Between Trenton and Newbern a 4-foot channel exists and the stream is in good condition. The maximum draft that can be carried June 30, 1909, to Trenton, 38 miles above the mouth, which is the head of navigation, is 4 feet.

Near the mouth the water level varies about 3 feet under normal conditions, according to the prevailing winds. Long protracted easterly or westerly winds sometimes cause a variation of 7 or 8 feet. At Trenton the stream is subject to freshets of about 5 to 15 feet during the winter months.

The commerce for the year 1908 amounted to 237,240 tons, valued at approximately $4,847,611, showing a decrease, compared with 1907, of 31,136 tons, valued at $7,217,867. This falling off in volume of commerce is directly attributable to the abandonment of a line of steamers formerly operated by the Norfolk and Southern Railway Company between Belhaven and Elizabeth City, after this company had built a railroad connecting these points.

The commerce carried consisted principally of fertilizers, general merchandise, machinery, timber, lumber, etc.

The effect of this improvement on freight rates is not known, but it affords transportation facilities to the town of Trenton, which has no other means except by wagon.

References: Annual Reports, 1879, page 711; 1900, pages 268 and 1802; 1901, page 1545.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

July 1, 1908, balance unexpended		$8,608.61
Amount received as rent during fiscal year		375.00
		8,983.61
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,079.17	
For maintenance of improvement	3,126.47	
		5,205.64
July 1, 1909, balance unexpended		3,777.97
July 1, 1909, outstanding liabilities		825.22
July 1, 1909, balance available		2,952.75
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

---

[a] See consolidated money statement on page 298.

CONSOLIDATED.

July 1, 1908, balance unexpended		$20,327.09
Amount received as rent during fiscal year		625.00
		20,952.09
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$6,465.01	
For maintenance of improvement	6,847.57	
		13,312.58
July 1, 1909, balance unexpended		7,639.51
July 1, 1909, outstanding liabilities		2,488.02
July 1, 1909, balance available		5,151.49
Amount (estimated) required for completion of existing project		72,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		33,000.00

(See Appendix M 5.)

6. *Inland waterway from Pamlico Sound to Beaufort Inlet, North Carolina.*—Distance from the 10-foot mean low-water contour in Adams Creek (a tributary of the Neuse River) to the head of Adams Creek is about 7 miles; from the head of Adams Creek across the country to the head of Core Creek is about 3 miles; from the head of Core Creek to the mouth of Core Creek is about 4 miles; and the distance from the mouth of Core Creek to the 10-foot depth at mean low water in the Newport River is about 4 miles, making the total distance over which dredging will be required about 18 miles.

At the time of the adoption of the existing project a low-water depth of about 5 feet could be carried from the 10-foot contour in Adams Creek to near its head; from the head of Adams Creek to the head of Core Creek is across dry land; from the head of Core Creek to its mouth the creek is practically bare at low water, and from the mouth of Core Creek to the 10-foot contour in Newport River the low-water depth formerly averaged about 6 feet.

The present and only project, adopted by act of Congress approved March 2, 1907, contemplates securing, by dredging, a channel 10 feet deep at low water from Pamlico Sound to Beaufort Inlet via Adams and Core creeks, said channel to have a minimum bottom width of 90 feet through dry land with side slopes of 1 to 2½, a minimum bottom width of 125 feet with side slopes of 1 to 3 through narrow parts of the creek and river portions, and a minimum bottom width of 250 feet with side slopes of 1 to 3 in wide parts of creeks and sounds, at an estimated cost of $550,000.

Amount expended on project for improvement to June 30, 1909, $101,012.90.

The work of the year consisted of laying out and superintending the work, purchasing 227.45 acres of land for the right of way, removing under contract 1,250,827 cubic yards of material from the prescribed cross section, completing 34,182.3 feet of channel, which varies in width from 90 to 250 feet, and starting the work of the construction of a steel highway bridge over Core Creek under contract.

The river and harbor act of March 2, 1907, authorized continuing contracts for completing the project in the sum of $350,000, of which $45,000 is yet to be appropriated.

The funds in hand will be used in completing the waterway, and the additional appropriation recommended will be applied to work of maintenance.

References: Pages 1393 and 1394, Report of the Chief of Engineers for 1904, and House Document No. 84, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$358,253.18
Amount appropriated by sundry civil act approved March 4, 1909	135,000.00
	493,253.18
June 30, 1909, amount expended during fiscal year, for works of improvement	89,266.08
July 1, 1909, balance unexpended	403,987.10
July 1, 1909, outstanding liabilities	48,611.97
July 1, 1909, balance available	355,375.13
July 1, 1909, amount covered by uncompleted contracts	279,868.49
Amount (estimated) required for completion of existing project	45,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,000.00

(See Appendix M 6.)

7. *Waterway between Newbern and Beaufort, N. C. (via Neuse River, Clubfoot Creek, Clubfoot and Harlowe Canal (private), Harlowe Creek, and Newport River).*—Distances: Newbern to Clubfoot Creek, 20 miles; thence to Clubfoot and Harlowe Canal, 6 miles; thence to Harlowe Creek, 3.2 miles; thence to Newport River, 3¼ miles; thence to Beaufort, 7 miles.

The first appropriation for this work was made by the river and harbor act of 1882, which provided that $5,000 from the appropriation for Neuse River and a like sum from the appropriation for Beaufort Harbor should be "applied to the improvement of the line of inland navigation from Newbern to Beaufort Harbor."

No estimate or project for said improvement had at that time been made, but in October, 1883 (Annual Report of the Chief of Engineers for 1884, p. 1067), an estimate was prepared which contemplated a channel 80 feet wide and 9 feet deep, at an estimated cost of $883,580, exclusive of the cost of a tide lock and of the canal company's franchise and property.

The available funds being totally inadequate for this improvement, the project adopted in 1884 for the expenditure of said funds contemplated a channel 30 feet wide and 5 feet deep at mean low water, the estimated cost being $92,000.

This project of 1884 constitutes the existing project.

All work of improvement has been confined to the natural channels in Clubfoot and Harlowe creeks and Newport River.

Amount expended on existing project to June 30, 1909:

For improvement	$29,739.84
For maintenance	7,260.16
Total	37,000.00

The expenditures during the year were for clearing the obstructions from Clubfoot and Harlowe creeks.

The governing depth in Harlowe Creek was increased several years ago to the project depth of 5 feet, but for lack of maintenance had decreased to about 1 foot in 1905. During the fiscal year 1907 the shoal at the mouth of the creek was redredged to the project depth, but another shoal of less consequence was left inside the creek. The channel in Clubfoot Creek had never been dredged until the fiscal year 1906. Some snagging, etc., had been done in both creeks, but no work in the canal connecting the two creeks has ever been done by the Government, since said canal is owned by a corporation.

The dredged cut at the mouth of Harlowe Creek has deteriorated considerably since its completion, but on account of the dredging done in Clubfoot Creek during the fiscal year 1906 and in 1907 those portions of the waterway under improvement are, on the whole, in better condition now than ever before, although there are many complaints of logs, etc., obstructing the private canal.

The controlling depth at mean low water is now from 2 to 2½ feet, the shoalest place being near the mouth of Harlowe Creek; but at high water about 4 feet can be carried, shoalest water being in the canal.

No additional appropriation is recommended for the maintenance of this waterway, as after the inland waterway from Pamlico Sound to Beaufort Inlet is completed the present route via Clubfoot and Harlowe Canal will not be required.

The commerce for the year 1908 amounted to 35,433 tons, valued at approximately $1,699,042, showing an increase over the commerce for 1907 of 6,903 tons. This commerce consisted principally of cotton, cotton seed, oysters, clams, timber, lumber, and general merchandise.

References: Annual Reports, 1884, page 106; 1890, page 1130; and 1896, page 113.

July 1, 1908, balance unexpended	$722.39
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	722.39
Amount (estimated) required for completion of existing project	55,000.00

(See Appendix M 7.)

8. Harbor at Beaufort, N. C.—When improvement (begun in 1836) was resumed in 1881, the erosion at Fort Macon and Shackelford points was causing serious deterioration of the inside channels and threatening deterioration of the bar channel. The governing low-water depth is said to have been 15 feet on the bar and 2 feet at Beaufort, N. C.

The original project is that of 1881, to stop erosion at the inlet (Fort Macon and Shackelford points) by jetties and to provide a channel 200 feet wide and 9 feet deep at ordinary low tide to Beaufort, and a channel 100 feet wide and 6 feet deep from Beaufort to the 6-foot contour of the channel leading up North River, estimated to cost $82,103.38, increased in 1885 to $159,000, when the project was modified by reducing the channel to Beaufort to 100 feet and its depth to 5 feet at mean low water and eliminating the channel east from Beaufort. In 1887 the estimate for the above work was further increased to $163,000.

The project was again modified in 1890, the project depth of the bulkhead channel being increased to 7 feet. The project as modified was completed.

The amount expended under the original project as modified was $148,843. To the above amount should be added $5,000, appropriated July 4, 1836, making the total cost up to the completion of the original project $153,843.

The existing project of 1896 includes the maintenance of jetties and sand fences at Fort Macon and Shackelford points and the maintenance of the 7-foot channel across Bulkhead shoal and thence to the wharves at Beaufort. The object of the jetties and sand fences is to protect the land on the opposite sides of the inlet, thus preventing the inlet from shifting and deteriorating.

The jetties have been successful in preventing the inlet from widening and shifting, but deterioration of the depths obtained in the main channel is quite rapid, due to the fact that the inlet is still too wide to enable its tidal discharge to keep the channel scoured out to the proper depth.

The river and harbor act of March 2, 1907, authorized a sufficient amount of the appropriation made therein to be applied to repairing existing jetties at Fort Macon Point and constructing additional jetties and shore protection.

The amount expended on present project for maintenance to June 30, 1909, was $30,601.99.

The expenditures of the year were for building and maintaining sand fences at Fort Macon and Shackelford points and for restoring the dredged channels in front of Beaufort and across Bulkhead shoal to 100 feet width and 7 feet depth at mean low water.

A draft of 7 feet at mean low water can now be carried to the wharves at Beaufort.

It is proposed to expend the available balance and the appropriation recommended in maintaining the dredged channels, building and maintaining sand fences at Fort Macon and Shackelford points, and possibly in repairing and building rock jetties at these points should erosion increase.

The tide rises 2 feet at Beaufort and 3 feet at the inlet.

The commerce for the year 1908 amounted to 46,178 tons, valued at approximately $2,137,369.

The maintenance of this channel tends to prevent the rise in freight rates by allowing the larger vessels to reach the wharves at Beaufort.

References: Annual Reports, 1881, page 1013; 1893, page 1457; 1896, page 1115; 1899, page 1498, House Document 1454, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$14,057.47
Amount received as rent during fiscal year	375.00
	14,432.47
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	10,152.46
July 1, 1909, balance unexpended	4,280.01

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	$5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M 8.)

9. Beaufort Inlet, North Carolina.—When improvement began in September, 1905, there was a minimum depth on the bar of approximately 12 feet at mean low water.

The original project, which is also the existing project, is printed on page 1415 of the Annual Report of the Chief of Engineers for 1904 and was adopted by Congress in 1905. It contemplates a channel 300 feet wide, 20 feet deep at mean low water, across the bar, to be obtained by dredging, at an estimated cost of $45,000.

Amount expended on existing project to June 30, 1909:	
For improvement	$44,484.24
For maintenance	439.36
Total	44,923.60

The work to date has consisted of the necessary surveys, etc., and the dredging of 426,630 cubic yards of material from the bar channel in 1906 and 1907. The result of this work was an increase of the minimum depth on the bar from 10.8 feet at mean low water when work began to about 20 feet on June 30, 1907, the minimum width of the 20-foot channel being about 200 feet. This channel has deteriorated during the past two years, the minimum mean low-water depth on June 30, 1909, being only 13 feet. The tide rises 3 feet at the inlet.

About 65 per cent of the project is completed.

There was no work done during the fiscal year.

It is proposed to expend the available balance and the appropriation recommended in restoring the dredged channel to the project depth, and obtaining the project width.

The commerce for the year 1908 amounted to 20,575 tons, valued at $700,625, and consisted principally of fish, lumber, cross-ties, and general merchandise.

Compared with the commerce for 1907, this shows a gain of 4,706 tons, or nearly 33 per cent.

The effect of this improvement will be to lessen freight rates by affording water transportation for products which have hitherto been dependent entirely upon railroads.

This work is designed to provide a deep-water outlet to the ocean for the inland waterway, Pamlico Sound to Beaufort Inlet, North Carolina.

References: Annual Reports 1881, page 1009; 1890, page 1118; 1896, page 1103.

July 1, 1908, balance unexpended	$5,203.07
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	20,203.07
June 30, 1909, amount expended during fiscal year for maintenance of improvement	126.67
July 1, 1909, balance unexpended	20,076.40

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	$15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M 9.)

10. New River, North Carolina, including inland waterways between Beaufort Harbor and New River and between New River and Swansboro.—The act of March 2, 1907, combined these three improvements under this new heading.

(*a*) *New River.*—Appropriations amounting to $50,000 were made for the river in 1836, 1837, and 1838, after which no further appropriations were made until 1882, when $5,000 was appropriated. Another appropriation of $5,000 was made in 1884; but since these amounts were considered too small to justify undertaking the improvements, no work was done until 1886, when still another appropriation, of $10,000, was made.

When improvement began in 1886, the governing low-water depth was 4 feet for a distance of 23 miles to Jacksonville, and the channel included two circuitous parts around Wrights Island and Cedar Bush Marsh.

The original project of 1886 was to dredge a cut 4 feet deep and 100 feet wide through Wrights Island and a second cut 4 feet deep and 150 feet wide through Cedar Bush Marsh. Both were completed, but the Cedar Bush Marsh cut deteriorated at the upper end and was abandoned, and the project of June 18, 1894, to obtain 4 feet depth around Cedar Bush Marsh by dredging and an experimental timber training wall was adopted and successfully carried out. The additional work required is for maintenance.

The act of March 3, 1905, authorized the balance from the project of 1894 to be expended in rebuilding the dike hitherto constructed. This was done, and the dike is now permanent.

Amount expended since civil war on previous projects	$20,442.35
Amount expended on present project of 1894 (as amended to date) up to June 30, 1909:	
For improvement	9,186.39
For maintenance (including rebuilding dike)	3,413.40
Total	33,042.14

The expenditures during the year were for office expenses.

It is proposed to apply the existing balance and the appropriation recommended to maintenance.

The project depth of 4 feet has twice been obtained and twice lost through lack of maintenance. The project depth now exists, although the channel is quite narrow near the head of the marshes. The tidal range at the inlet is about 3½ feet and at the head of the marshes about 1 foot. The head of navigation for all practical purposes is Tar Landing, 3 miles above Jacksonville and 26 miles from the mouth of the river, to which a present depth of 4 feet can be carried. The depth on the bar at the mouth of the river is now 4 feet, but varies from time to time.

The commerce for 1908 amounted to 4,487 tons, valued at $189,360. It consisted principally of timber, fish, cotton, cotton seed, and general merchandise. The decrease from last year is due principally to the shutting down temporarily of the sawmills at and near Jacksonville.

In its present condition this stream probably has very little effect on freight rates in general, but it affords transportation for products which would otherwise have no means of transportation except by wagon. If the bar and channel were sufficiently improved to justify a line of steam vessels between Wilmington and Jacksonville, freight could probably be carried to the latter point much more cheaply than at present.

References: Annual Reports, 1882, page 1117; 1886, page 992; 1891, page 1380; 1899, page 1501, and 1907, page 277.

July 1, 1908, balance unexpended	$1,963.55
June 30, 1909, amount expended during fiscal year for maintenance of improvement	5.59
July 1, 1909, balance unexpended	1,957.96
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a]

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*b*) *Waterway between New River and Swansboro, N. C.*—This waterway is a part of the waterway between Beaufort Harbor and New River (see pp. 1124–1127, Annual Report of the Chief of Engineers for 1889), but in 1890 two separate appropriations were made—one for the "Inland waterway between Beaufort Harbor and New River" and the other for the "Waterway between New River and Swansboro," and hence separate reports are made for the two improvements, although one embraces the other.

This waterway is about 22 miles long and originally consisted of tortuous tidal channels winding through the marine marsh, which extends from Swansboro to New River, between the mainland on the one side and the barrier beach or "banks" (which separates it from the ocean) on the other. In the vicinity of the four inlets communicating with the ocean the width of the waterway was several hundred feet and its depth from 12 to 15 feet, while between them its width diminished to about 12 feet in places and its depth to 6 inches at ordinary low water.

The original and existing project, adopted in 1889, is to enlarge the waterway by dredging to a minimum width of 40 feet and minimum depth of 3 to 4 feet at mean high water, at an estimated total cost of $43,000.

Until June 13, 1906, no work except a survey made in April and May, 1901, had ever been done on this waterway, for the reason that an act of the general assembly of North Carolina, ratified February 13, 1889, had incorporated the Wrightsville and Onslow Navigation Company, with the exclusive right to navigate said waterway, as set forth in House Executive Document No. 26, Fifty-second Congress, first session (p. 1147 of the Annual Report of the Chief of Engineers for 1892).

On February 6, 1905, however, a paper was obtained from the two survivors of the four parties named in the charter of said Wrightsville and Onslow Navigation Company, in which paper it was declared that the privileges and franchises granted in said charter had never been exercised and that said privileges and franchises had "to all intents and purposes been surrendered and abandoned."

---

[a] See consolidated money statement on page 307.

All obstacles in the way of government improvement having been thus removed, work was begun as soon as plant for the purpose could be spared from other more pressing work.

Amount expended on existing project up to June 30, 1909:	
For improvement	$20,825.00
For maintenance	800.00
Total	21,625.00

The expenditures for the year were $3,952.14.

Dredging operations were carried on between August 16 and December 4, 1908, using government plant and hired labor. As a result of this work the project depth now exists throughout the entire waterway. There are, however, several places where the project width has not been secured. It is estimated that the project is about 80 per cent completed.

It is proposed to apply the available balance and the additional appropriation recommended to the maintenance of the present dredged cuts and in obtaining the project width.

The rise and fall of the tide varies from 2.2 to 4 feet in the neighborhood of the inlets to about 1 foot at the points most distant from the inlets.

The commerce of 1908 amounted to 5,208 tons, at an approximate value of $238,735. It consisted principally of cotton, fish, oysters, clams, and fertilizers. This can not be taken as an indication of the amount of commerce that will utilize the waterway now that the proposed improvement has been made, for the difficulty and delay incident to navigation were formerly so great that commerce naturally sought other routes.

The improvement of this waterway will probably have no direct effect upon freight rates, but it will afford means of transportation for large quantities of timber, lumber, and miscellaneous products that now have no outlet except by wagon or by the smallest draft boats.

References: For description of this waterway see Annual Reports for 1892, page 1146, and 1893, pages 1399 and 1400.

July 1, 1908, balance unexpended		$202.14
Amount transferred from waterway, Beaufort Harbor to New River		3,500.00
Amount alloted from appropriation by river and harbor act approved March 3, 1909		4,000.00
Amount received as rent during fiscal year		250.00
		7,952.14
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$3,652.14	
For maintenance of improvement	300.00	
		3,952.14
July 1, 1909, balance unexpended		4,000.00
Amount (estimated) required for completion of existing project		26,000.00

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	[a]
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*c*) *Waterway between Beaufort Harbor and New River* (*i. e., portion between Beaufort and Swansboro*).—Distance from Beaufort to Swansboro, 30 miles, with access at Swansboro to the Atlantic Ocean through Bogue Inlet.

When improvement began in 1886 the governing low-water depth was 18 inches to Swansboro.

The original project is that of 1885, to provide a channel 100 feet wide and 3 feet deep at ordinary low water between Beaufort Harbor and Swansboro, estimated to cost $6,000. This estimate was increased in 1887 to $50,000 and again increased in 1892 to $71,040.

No project was adopted originally for the part beyond Swansboro, but in 1889 a separate project for a channel 40 feet wide by 3 or 4 feet deep over this portion of the waterway was adopted, the estimated cost being $43,000. The act of 1890 made a separate appropriation of $5,000 for this portion of the route, designating it as the "Waterway between New River and Swansboro." (See pp. 1376–1378, Annual Report of the Chief of Engineers for 1891.)

The project is about 85 per cent completed.

The amount expended on present project to June 30, 1909, for improvement is $51,832.56.

No work was done during the fiscal year, the expenditures being for office expenses.

At the close of the fiscal year 1907 the project depth of 3 feet prevailed throughout the entire length of 30 miles between Beaufort Harbor and Swansboro, the dredged channel being 100 feet wide (project width) through one shoal 980 feet long, 60 feet wide through six shoals aggregating 24,696 feet in length, and 40 feet wide through another shoal 874 feet long.

It is reported that no shoaling of any consequence has taken place in the past two years, and hence the above conditions may be taken as the conditions prevailing June 30, 1909.

The tide at Beaufort Inlet at the eastern end of this waterway and at Bogue Inlet (the western end of the portion improved under appropriations for waterway between Beaufort Harbor and New River) has a range of about 3½ feet. Where the tides meet in Bogue Sound the range is only about 1 foot.

The commerce during the calendar year 1908 amounted to 27,372 tons, valued at $1,097,205. The commerce consisted chiefly of lumber, shingles, etc., fish, oysters and clams, rosin and turpentine, miscellaneous farm products, fertilizers, and general merchandise.

It is proposed to use the balance of funds remaining unexpended and the appropriation recommended in maintenance and in increasing the width of the dredged cuts to the project width of 100 feet.

References: Annual Report, 1885, page 1133; 1891, page 1378; 1892, page 1141; 1893, page 1397; 1894, page 1034; 1896, page 1117; 1897, page 1398.

---

[a] See consolidated money statement on page 307.

July 1, 1908, balance unexpended	$4,167.64
Amount allotted from appropriation by river and harbor act approved March 3, 1909	1,000.00
	5,167.64
Amount transferred to waterway between New River and Swansboro, N. C., during fiscal year	3,500.00
	1,667.64
June 30, 1909, amount expended during fiscal year, for works of improvement	.20
July 1, 1909, balance unexpended	1,667.44
Amount (estimated) required for completion of existing project	16,040.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

CONSOLIDATED.

July 1, 1908, balance unexpended		$6,333.33
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
Amount received as rent during fiscal year		250.00
		11,583.33
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$3,652.14	
For maintenance of improvement	305.79	
		3,957.93
July 1, 1909, balance unexpended		7,625.40
Amount (estimated) required for completion of existing project		42,040.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		25,000.00

(See Appendix M 10.)

11. Northeast and Black rivers, and Cape Fear River above Wilmington, N. C.—(a) Northeast River.—Distance from mouth to Bannerman's bridge, 48 miles; to Hallsville, 88 miles; to Kornegay's bridge, the head of navigation, 103 miles.

The original condition when improvement began was a channel badly obstructed by logs, snags, and overhanging trees. The river was navigable to Bannerman's bridge, with governing low-water depth of 6 feet.

The original project of 1889 is still in force, and includes the clearing of the natural channel for small steamers to Hallsville and for pole boats to Kornegay's bridge at an estimated cost of $30,000.

Additional work proposed is for maintenance only, the project having been practically completed.

Amount expended on present project up to June 30, 1909:	
For improvement	$10,687.96
For maintenance	11,801.08
Total	22,489.04

---

[a] See consolidated money statement on this page.

The work done during the year consisted of snagging for maintenance and part construction of new hull for snagboat *H. G. Wright.*

As the result of the expenditures to date the channel has been kept cleared, except when it has been impracticable on account of low water or for other causes for the plant to work. Six feet of water can be carried to Bannerman's bridge and 3 feet to Croom's bridge during all stages of the water.

From Croom's bridge to Kornegay's bridge, the head of navigation, the river is so shallow that navigation is practicable only when the water is up. This is liable to occur at any time, but during the summer low stages usually prevail.

The minimum low-water depth to Bannerman's bridge is 6 feet; to Croom's bridge, 3 feet; to Hallsville, 0.5 foot; to Kornegay's bridge (the head of navigation), 0.1 foot.

With the available balance it is proposed to maintain the natural channel to Hallsville.

The additional appropriation recommended is for maintenance.

There is a tidal range of about 2 feet at the mouth of this stream, which decreases to nothing at or a short distance above Bannerman's bridge. The upper portion is subject to freshets of from 8 to 12 feet.

The channel is at present badly obstructed by snags, etc., above the seventy-fifth milepost and is partially obstructed below that point.

The commerce for 1908 amounted to 101,861 tons, valued at approximately $1,618,730. It consisted principally of timber, naval stores, fertilizers, general merchandise, cotton, and miscellaneous farm products.

The commerce is handled on a few boats that make some attempt at regular trips and on a large number of rafts, flats, etc. Hence it is impossible to estimate the commerce with much accuracy.

References: Annual Reports, 1885, page 1123; 1890, page 1181; 1895, page 1389; 1896, page 1122, and 1907, page 282.

July 1, 1908, balance unexpended	$3,023.62
Amount allotted from appropriation by river and harbor act approved March 3, 1909	6,000.00
	9,023.62
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,769.33
July 1, 1909, balance unexpended	7,254.29
July 1, 1909, outstanding liabilities	155.01
July 1, 1909, balance available	7,099.28
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a]

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*b*) *Black River.*—The original condition when improvement began was a natural channel cleared fairly to Point Caswell and roughly to Lisbon, with governing low-water depths of 4 feet to Point Caswell, 2.5 feet to Haws Narrows, and 1.5 feet to Lisbon.

---

[a] See consolidated money statement on page 311.

The original project of 1885 included clearing the natural channel and banks to Lisbon and the cutting off of a few sharp points at bends. It was amended in May, 1893, by omitting that part of the river above Clear Run, and, as amended, was completed September 20, 1895.

The existing project of 1894 is to maintain the natural channel to Clear Run, at an estimated cost of $2,000 per annum.

Amount expended to June 30, 1909:	
On previous project mentioned above	$12,358.40
On present project, for maintenance	10,103.18
Total	22,461.58

The expenditures during the year resulted in the removal of the worst obstructions between the mouth and Clear Run.

The result obtained by the expenditures to date has been a cleared channel whenever funds were available, permitting navigation to Point Caswell, 24 miles above the mouth, at all stages, and to Clear Run, 66 miles above the mouth, at stages of 1.5 feet or higher above low water, the governing low-water depths at present being 5 feet to Point Caswell, 2.5 feet to Haws Narrows, 32 miles above the mouth, and 1.5 feet to Clear Run. There is no steamboat navigation above Clear Run. Lisbon, 74 miles from the mouth, is the head of navigation. The low-water stages prevail usually from May to August, inclusive; during the rest of the year the stage is about 5 to 8 feet higher, but the periods of high and low water are by no means the same every year. No further work, excepting maintenance, is now proposed.

It is proposed to expend the available balance for maintenance of the natural channel up as far as Clear Run, and the appropriation recommended is for further maintenance as required.

The commerce during 1908 amounted to 45,998 tons; estimated value $958,409. It consisted principally of timber, general merchandise, naval stores, fertilizers, cotton, and other farm products.

The commerce is handled on a few boats, which make some attempt at regularity, and on a large number of rafts, flats, etc., whose trips are altogether irregular. Hence it is impossible to get the commercial statistics with even fair accuracy.

References: For history, see Annual Report for 1896, page 1125. For report on examination, see Annual Report for 1907, page 281.

July 1, 1908, balance unexpended	$3,178.77
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	7,178.77
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	897.01
July 1, 1909, balance unexpended	6,281.76
July 1, 1909, outstanding liabilities	407.65
July 1, 1909, balance available	5,874.11
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

---

[a] See consolidated money statement on page 311.

(*c*) *Cape Fear River above Wilmington, N. C.*—The original condition when work began was a channel badly obstructed above Kellys Cove by logs, snags, etc., and with governing low-water depths of 4 feet to Kellys Cove and 1 foot to Fayetteville.

The original project of January 26, 1881, was to clear the river to Fayetteville and obtain a continuous channel by jettying and dredging, estimated in July, 1893, to cost $275,000 for a channel 4 feet deep to Elizabethtown and 3 feet deep to Fayetteville. It is about 30 per cent completed.

The existing project, adopted by act of June 13, 1902, is to obtain, by canalizing, a low-water depth of 8 feet to Fayetteville, at an estimated cost of $1,350,000.

In consequence of this new project the former project has been abandoned, excepting for the maintenance of the natural channel, pending the construction of locks and dams.

Amount expended on project of 1881 to June 30, 1909:	
For improvement	$134,436.96
For maintenance	20,060.81
Total	154,497.77
Amount expended on project of 1902 to June 30, 1909, for improvement	14,682.23
Total	169,180.00

The work done during the year consisted in removing obstructions in the river between the twenty-sixth and twenty-seventh mileboards caused by the caving of banks, in the partial construction of a new hull for the snagboat *H. G. Wright* for use on this and neighboring streams, inspection, and office work.

The additional appropriation asked for will be devoted to continuing the work of maintenance by open-channel work.

At present the low-water depths are 8 feet to Kings Bluff, 38 miles above Wilmington; 2½ feet to Elizabethtown, 73 miles above Wilmington; and 2 feet to Fayetteville, 115 miles above Wilmington. Fayetteville is the head of navigation. Low-water stages prevail from two to four months during each summer, and freshets, which raise the water level from 15 to 50 feet at Fayetteville (the effects lower down being less marked), usually occur as often as once a month during the rest of the year. They do not occur with any regularity, however.

The commerce for 1908 was estimated at 137,620 tons, estimated to be worth $3,960,235.

Locks and dams.—The act of June 13, 1902, appropriated $50,000 for the purchase of sites for locks and dams. A careful survey, consuming more than eleven months' time, was made for the purpose of locating the sites. This survey has been completed, the sites tentatively located, a number of borings made at each site, the locations approved, and prices obtained on all the lands necessary.

The balance of this appropriation for lock and dam improvement, $35,317.77, has been covered into the surplus fund, in accordance with section 10 of the sundry civil act of March 4, 1909.

Abstracts of the titles were made and turned over to the United States district attorney for examination. The titles to the land needed at lower site were approved and the land purchased.

Owing to the fact that Congress has directed a reexamination of this river, with a view to a possible modification of the project, the purchase of the other land has been delayed, as its purchase may not be required.

No estimate is submitted for further work on the existing project for locks and dams, pending action by Congress on the modified plan for this improvement contained in House Document No. 890, Sixtieth Congress, first session, which is based on the reexamination authorized by the river and harbor act of March 2, 1907.

The expenditures to June 30, 1909, on said project for surveys, other preliminaries, and purchasing land at lower site, amounted to $14,682.23.

The expenditures for the year were for inspection and office expenses.

References: Annual Reports for 1872, page 742: 1881, page 1018: 1901, page 1559; and 1904, page 1493.

CAPE FEAR RIVER ABOVE WILMINGTON (OPEN CHANNEL IMPROVEMENT).

July 1, 1908, balance unexpended	$7,371.56
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,205.00
July 1, 1909, balance unexpended	4,166.56
July 1, 1909, outstanding liabilities	500.62
July 1, 1909, balance available	3,665.94
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CONSOLIDATED.

July 1, 1908, balance unexpended	$13,573.95
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	23,573.95
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,871.34
July 1, 1909, balance unexpended	17,702.61
July 1, 1909, outstanding liabilities	1,063.28
July 1, 1909, balance available	16,639.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	14,000.00

CAPE FEAR RIVER ABOVE WILMINGTON, LOCKS AND DAMS.

July 1, 1908, balance unexpended		$35,526.11
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$208.34	
Covered into the surplus fund	35,317.77	
		35,526.11
Amount (estimated) required for completion of existing project		1,300,000.00

(See Appendix M 11.)

12. Cape Fear River, North Carolina, at and below Wilmington.—The condition of the river prior to the opening of New Inlet (which seems to have occurred during an equinoctial storm in 1761) is rather

---

[a] See consolidated money statement on this page.

uncertain, but old maps indicate that there was a low-water depth of 14 feet across the bar at the mouth, the least depth between Wilmington and the mouth being 7.5 feet. There is also some uncertainty as to the conditions in 1829, when the improvement was first undertaken by the United States, but the most reliable information is that there was then about 7 to 7.5 feet at low water in the river, about 9 feet in Baldhead channel, 9 feet in the Rip channel, and 10 feet at New Inlet. Work on the bar was first begun in 1853, at which time the bar depths at low water were 7.5 feet in Baldhead channel, 7 feet in Rip channel, and 8 feet at New Inlet, the governing low-water depths in the river having been increased to 9 feet.

The original project of 1827 was to deepen by jetties the channel through the shoals in the 8 miles next below Wilmington. This project resulted in a gain of 2 feet available depth. The project of 1853 was to straighten and deepen the bar channel by dredging, jettying, diverting flow from the New Inlet, and closing breaches in Zekes Island. This project was incomplete when the civil war began.

After the civil war the first project was that of 1870, to deepen the bar channel by closing breaches between Smiths and Zekes Islands, with the ultimate closure of New Inlet in view. The project of 1873 included that of 1870, and in addition the dredging of the bar channel and closing of New Inlet. The project of 1874 was to obtain by dredging a channel 100 feet wide and 12 feet deep at low water up to Wilmington. The project of 1881 was to obtain by dredging a channel 270 feet wide and 16 feet deep at low water up to Wilmington. These projects had been practically completed in 1889.

The project adopted September 19, 1890 (see Annual Report of the Chief of Engineers for 1889, p. 1132), is to obtain a mean low-water depth of 20 feet and a width of 270 feet from Wilmington to the ocean, at an estimated cost of $1,800,000. This project was modified by act of June 13, 1902, to authorize the construction of mooring dolphins at Wilmington at a cost of $30,000, and to provide for the removal of obstructions at mouth of Brunswick River, at an estimated cost of $1,000. The project was modified by the river and harbor act of March 2, 1907, which provides for continuing improvement in accordance with report submitted in House Document No. 545, Fifty-ninth Congress, first session, for completion of the 20-foot project to the projected width, by dredging and the excavation of a mooring basin in lieu of constructing mooring dolphins at Wilmington, involving a reduction in the estimate of cost to $1,392,750, including removal of obstructions at mouth of Brunswick River. The act also authorized improvement to such depth in excess of 20 feet as appropriations for the work may permit, due regard being given to the difference in tidal oscillation at the upper and lower portions of the improvement, and authorizes so much as may be necessary of the funds available to be applied to repairing the New Inlet and Swash Defense dams. The cost of these repairs is estimated at $165,000. Annual maintenance is estimated to cost $65,000.

The river and harbor act of March 2, 1907, appropriated the sum of $165,000 for improvement and authorized an additional expenditure of $250,000, all of which has since been appropriated, and the river and harbor act of March 3, 1909, provided an additional appropriation of $300,000 for this improvement.

No contracts for improvement have yet been made.

EXPENDITURES.

Prior to civil war (including balance transferred)		$363,228.92
Since civil war on prior projects		2,102,271.93
On existing project to June 30, 1909:		
For improvement	$1,430,798.54	
For maintenance	447,729.45	
		1,878,527.99
Total		4,344,028.84

On September 17, 1906, a storm of extreme violence very materially injured Swash Defense and New Inlet dams throughout their entire length and wholly destroyed Swash Defense dam in several places.

The total results obtained on the project up to the end of the fiscal year may be summarized as follows:

From the ocean to the lower end of Reaves Point Shoal there is a 22-foot mean low-water channel with a least width of 150 feet. At Reaves Point the channel is 20 feet deep and 270 feet wide, and from Reaves Point to Wilmington there is a channel 22 to 24 feet deep of varying widths. The repairs to Swash Defense dams are about 60 per cent completed.

The average rise of the tides is 4½ feet at the ocean bar, 3½ feet at Keg Island, and 2½ feet at Wilmington.

The distance from the ocean bar to Wilmington is 30 miles, and the river is navigable 115 miles farther up to Fayetteville, the head of navigation.

The additional work proposed with funds on hand and the additional sum requested is toward the prosecution of the project and maintenance during the progress of the improvement.

The commerce of the year 1908 amounted to 864,071 tons, valued at $49,753,175.

The commerce consisted principally of cotton, cotton-seed meal, naval stores, manufactured lumber, shingles, fertilizers, fertilizer material, coal, gum logs, cross ties, and general merchandise.

As a result of the improvement, vessels coming to Wilmington are much larger than formerly, the average tonnage in 1886 being 421, while in 1908 the average was 1,345. This increase in tonnage has caused a corresponding decrease in freight rates on shipments by water.

References: For special descriptions, see Annual Reports of the Chief of Engineers for 1873, page 44; 1887, page 1047; 1895, page 1335; 1896, page 1131; 1901, page 1552, and 1907, page 287.

July 1, 1908, balance unexpended		$280,071.30
Amount allotted from appropriation by river and harbor act approved March 3, 1909		300,000.00
Amount appropriated by sundry civil act approved March 4, 1909		100,000.00
Amount received from sales during fiscal year		250.37
		680,321.67
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$202,865.56	
For maintenance of improvement	60,000.00	
		[a] 262,865.56
July 1, 1909, balance unexpended		417,456.11
July 1, 1909, outstanding liabilities		17,076.36
July 1, 1909, balance available		[b] 400,379.75

---

[a] Exclusive of $1,000 expended in work at Fort Caswell for the Quartermaster's Department, for which this appropriation is to receive reimbursement.

[b] Includes the $1,000 reimbursement due from the Quartermaster's Department.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	$500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M 12.)

13. Shallotte River, North Carolina.—Before improvement was begun the channel depth on the ocean bar was about 3 feet at low water and 7½ feet at high water. From the bar to a point 2¼ miles above there is a 5-foot low-water channel; the next 1¾ miles was badly obstructed by mud flats and oysters rocks, over which there was about 1 foot depth at low water. From this point to the town of Shallotte, 8 miles farther up, the river was narrow and crooked and the low-water depth varied from 2 to 12 feet.

Act of Congress approved March 2, 1907, appropriated $3,000 to be expended on this river. This appropriation not being based on any previous project, the project submitted to and approved by the Chief of Engineers for the expenditure of the funds available became the project.

This project is to dredge a channel 35 feet wide and 4 feet deep at low water, following the best water along the western shore, between a point 2½ miles above the inlet and a point 4 miles above the inlet.

Active work of improvement began June 22, 1908, and the project was completed August 8, 1908. The amount expended on project to June 30, 1909, was $3,000, all of which was for improvement.

The river is tidal, there being a rise and fall of tide of approximately 3 feet at the town of Shallotte, which is the head of schooner navigation.

At mean low water a draft of 4 feet can now be carried to Old Still Landing and 2 feet about 2 miles farther up to the town of Shallotte, which is practically the head of navigation.

The commerce for the year 1908 amounted to 4,190 tons, valued at $227,569, and consisted principally of general merchandise, naval stores, etc.

The volume of commerce reported for 1908 shows a decrease of over 50 per cent compared with that of 1907. It is not believed, however, that there has been such a falling off as is indicated, but that the amounts reported for 1907 by the parties interested were more than that actually carried. It is therefore believed that the commerce reported for 1908 is more nearly correct.

The effect of the proposed improvement on freight rates is not known, but the stream affords an outlet to products, which have no outlet except by wagon.

Reference: See Annual Report 1890, page 1184, and 1907, page 1252.

July 1, 1908, balance unexpended	$2,843.17
June 30, 1909, amount expended during fiscal year for works if improvement	2,843.17

(See Appendix M 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—An allotment of $100 was made from this appropriation on December 26, 1907, for removing two wrecks opposite the western end of the military reservation of Fort Caswell, N. C., near the mouth of the Cape Fear River, North Carolina.

At the close of the fiscal year no work had been done. The expenditure during the year amounted to $25.52.

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination and survey of New River, North Carolina, with a view to obtaining a depth of 5 feet from its mouth to Jacksonville.—Reports dated September 11, 1907, and June 22, 1908, respectively, are printed in House Document No. 1085, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $6,700 is presented.

2. Preliminary examination and survey of Beaufort Inlet and Harbor, North Carolina, with a view to securing a channel depth of 25 feet across the bar.—Reports dated July 23, 1907, and October 1, 1908, respectively, are printed in House Document No. 1454, Sixtieth Congress, second session. The locality is not considered worthy of improvement by the General Government to the extent of providing a channel depth of 25 feet across the bar.

3. Preliminary examination and survey of Trent River, North Carolina, with a view to obtaining 8 feet of water from Newbern to Trenton.—Reports dated August 27, 1907, and October 3, 1908, respectively, are printed in House Document No. 1471, Sixtieth Congress, second session. A plan for obtaining and maintaining a navigable depth of 4 feet up to Trenton at an estimated cost of $15,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE CHARLESTON, SOUTH CAROLINA, DISTRICT.

This district was in the charge of Capt. E. R. Stuart, Corps of Engineers, to July 13, 1908; in the temporary charge of Col. Dan C. Kingman, Corps of Engineers, from July 13 to July 24, 1908; in the charge of Capt. E. M. Adams, Corps of Engineers, from July 24, 1908, to June 2, 1909, and in the temporary charge of Capt. Earl I. Brown, Corps of Engineers, since June 2, 1909. Division engineer, Col. Dan C. Kingman, Corps of Engineers.

1. Waccamaw River, North Carolina and South Carolina, and Little Pedee River, South Carolina.—(*a*) *Waccamaw River.*—In 1880 this stream was navigable for 12-foot-draft boats at all stages of water from Georgetown, 23 miles, to Bull Creek, and at high water 4 miles farther, to Bucks lower mills; thence for 7-foot-draft boats, at high water, 22 miles farther, to Conway; thence it possessed an obstructed channel for 3-foot-draft boats, at ordinary winter water, 68 miles, to Reeves Ferry; thence an obstructed channel, with 3 feet at high water, for 30 miles, to Lake Waccamaw.

The project of improvement, adopted in 1880, provides for a channel 12 feet deep at all stages of water, with 80 feet bottom width from the mouth of the river to Conway, thence a cleared channel to Lake Waccamaw.

The original estimated cost was $29,370, which was revised in 1885 and increased in the annual report of that year to the present figure, $138,400. In the Annual Report of the Chief of Engineers for 1886, page 170, maintenance is estimated at $4,000 per year after completion of improvement.

The total expenditure to June 30, 1909, was $143,552.79. The river had been cleared of snags to a distance of 128 miles above the mouth, and this portion of the river had been frequently resnagged as appropriations permitted, 46,201 snags, etc., having been removed since June 30, 1884. Some work had been done toward increasing the original depth on eight shoals below Conway. As nearly as can be determined from the records, about $75,977.81 had been expended in originally snagging the lower 128 miles of the river and in constructing pile and plank dikes at eight shoals, and $35,435.11 in maintenance.

Dredging was begun in 1903 to obtain a 6-foot channel below Conway and to straighten the river by cutting through the worst bends. The expenditure during the year was for continuing this work at Thoroughfare Cut-off; the total amount of material removed during the year was 23,731 cubic yards, and the aggregate to June 30, 1909, 139,500 cubic yards.

The approved project is about 85 per cent completed.

The available depths reported as now existing do not differ greatly from the original depths. At mean low water about 12 feet can be carried to Bucksville, 34 miles above the mouth; 6 feet to Conway, 50 miles; about 2 feet to Wortham's bridge, 97 miles. At high water large side-wheelers can go to Red Bluff, 74 miles, and small boats to Reeves Ferry, 117 miles.

Lake Waccamaw, 147 miles above the mouth, is the head of navigation.

The usual variation in water level is about 7.5 feet at Conway, 50 miles above the mouth, and about 12 feet at Star Bluff, 84 miles above the mouth.

The appropriation recommended will be applied to dredging and snagging.

The tidal influence at low water extends 97 miles above the mouth.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1902	141,686	$1,844,019	1906	244,920	$3,720,000
1903	143,813	1,884,700	1907	295,135	4,050,550
1904	190,435	2,119,040	1908	93,743	3,258,677
1905	207,630	2,665,917			

The vessels engaged in traffic on this river are steamers and tugboats of from 10 to 550 tons, seagoing schooners of from 300 to 500 tons, pole boats, rafts, etc. The additional work proposed is necessary to make the improvement available.

No new line of transportation was established during the year.

For references to examinations and surveys, see page 246, Annual Report of the Chief of Engineers, 1904.

It has been found impossible to obtain information concerning the effect of the improvement on freight rates.

July 1, 1908, balance unexpended	$2,491.71
Receipts, account of sales	20.01
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	6,511.72
June 30, 1909, amount expended during fiscal year, for works of improvement	2,344.50
July 1, 1909, balance unexpended	4,167.22
Amount (estimated) required for completion of existing project	28,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(b) *Little Pedee River.*—The river in its original condition was much obstructed by snags and overhanging trees and by 10 bridges without draws. In places it was divided into several branches, in none of which was there a good channel.

Under the plan of improvement adopted in 1888 it is proposed to snag the river and close unnecessary branches, providing for steamboat navigation up to the mouth of Lumber River, 65 miles, and for pole-boat navigation 48 miles farther, to Little Rock, at an estimated cost of $50,000.

The total expenditures to June 30, 1909, were $25,074.01. The river had been well snagged up to the mouth of Lumber River and roughly cleared for pole-boat navigation to Little Rock. No work had been done toward increasing the original depths. As nearly as could be determined from the records, about $19,549.99 had been expended in originally snagging the river, and about $5,524.02 in maintenance. About 50 per cent of the project has been completed.

There were no operations during the year. Expenditures shown, $21, were for repairs to plant.

The aggregate number of obstructions removed since beginning of the improvement in 1888 is 31,718.

The appropriation recommended will be applied to snagging portions of the river as yet untouched and to work of maintenance.

The available depths now existing do not probably differ greatly from the original depths. No permanent improvement can be effected toward increasing the maximum draft over the shoals without considerable dredging, which was not provided for in the original project. The usual variation in water level at Gilchrist Bridge, about 65.5 miles above the mouth, is about 9.5 feet.

---

[a] See consolidated money statement on page 318.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	4,614	$52,760	1900	23,780	$173,500
1892	7,115	92,964	1901	51,460	399,000
1893	6,153	101,535	1902	57,050	416,000
1894	8,375	114,600	1903	77,750	560,500
1895	12,438	117,470	1904	83,100	645,000
1896	17,050	198,500	1905	87,985	663.650
1897	13,162	100,400	1906	18,880	389,500
1898	11,900	105,750	1907	14,513	243,250
1899	16,685	144,787	1908	11,992	97,290

Vessels ply on the river as far as Gallivant's bridge, 47 miles above its mouth; the river is probably navigable at its mean low-water stage for boats with 3-foot draft as far as Gallivant's bridge. The head of navigation is Little Rock, 113 miles above the mouth. No new line of transportation was established during the year.

The balance on hand will be spent in maintaining the channel.

For outline map of river, see page 1214, Annual Report of the Chief of Engineers for 1890. For preliminary examination and survey, see page 1111, Annual Report of the Chief of Engineers for 1887.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1908, balance unexpended	$1,646.99
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	21.00
July 1, 1909, balance unexpended	1,625.99
Amount (estimated) required for completion of existing project	23,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CONSOLIDATED.

July 1, 1908, balance unexpended		$4,138.70
Receipts, account of sales		20.01
Amount allotted from appropriation by river and harbor act approved March 3, 1909		4,000.00
		8,158.71
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,344.50	
For maintenance of improvement	21.00	
		2,365.50
July 1, 1909, balance unexpended		5,793.21
Amount (estimated) required for completion of existing project		52,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		44,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix N 1.)

---

[a] See consolidated money statement on this page.

2. *Lynch River and Clark Creek, South Carolina.*—Lynch River is a tributary of the Great Pedee River, into which it flows a few miles above Smiths Mills at a point about 65 miles above the mouth of the Great Pedee River. Shortly above this point a branch of Lynch River, known as Clark Creek, leaves it, and, flowing about 7 miles, empties into the Great Pedee River about 10½ miles below the mouth of Lynch River. The mouth of Lynch River was completely filled with drift coming in from the Great Pedee River, thus forcing all traffic to come down Clark Creek. Its upper end was also choked by this drift.

The project of improvement adopted in 1888 provided for roughly clearing a channel in Clark Creek, to afford an outlet for Lynch River. The estimated cost was $7,500. The money was appropriated from 1888 to 1892, inclusive, and was expended in roughly clearing a channel 40 feet wide and 3 feet deep. As no further appropriations were made, the channel filled up and no permanent improvement was effected.

The river and harbor act of March 2, 1907, appropriated $2,000 for improving Lynch River and Clark Creek by the removal of logs and snags. The adopted project provides for removing obstructions, as far as these funds will allow, to permit the passage of rafts through the lower end of Clark Creek through a small connecting stream between Clark Creek and Lynch River, known as Lawrence Cut, and through Lynch River.

The total expenditure to June 30, 1909, under the existing project was $1,225.67.

During the year no work was done on account of high stage of water and small balance available.

Commercial statistics.

Year.		Tons.	Value.
1906	Outward freights, logs	3,552	$13,000
1907	Outward freights, logs	1,500	15,000
1908	Timber	2,000	25,000

There is no other commerce on this stream.

There is no navigation, save by rafts.

For map of Clark Creek, see page 1204, Annual Report of the Chief of Engineers, 1890. For reports of examinations of Lynch River, see Annual Reports of the Chief of Engineers for 1881, page 1038; 1893, page 1532; and 1900, page 1877.

July 1, 1908, balance unexpended	$629.75
July 1, 1909, balance unexpended	629.75

(See Appendix N 2.)

3. *Great Pedee River, South Carolina.*—The river in its original condition was dangerously obstructed by logs everywhere. Boats drawing 9 feet of water were able to reach Smiths Mills, 52 miles above the mouth. Those drawing 3½ feet could get 54 miles farther up at low water to Little Bluff, or at high water to Cheraw, 167 miles from the mouth.

The project of improvement adopted in 1880 provides for a thoroughly cleared 9-foot navigation to Smiths Mills and a 3½-foot navigation to Cheraw at all stages of water.

The original project contained no estimate of cost. From 1880 to 1886, inclusive, $47,000 was appropriated. In the Annual Report of the Chief of Engineers for 1886, page 170, it was estimated that $70,000 in addition to this $47,000 would complete the improvement, and that $5,000 a year would be required for maintenance.

A project for the improvement of the upper river (the 64 miles between Cheraw and the bridge of the Wilmington, Columbia and Augusta Railroad) was adopted in 1902. (See Annual Report of the Chief of Engineers for 1901, p. 1607.) This project provides for obtaining, by snagging and dredging, a cleared channel, with a least depth of 3½ feet at mean low water, at a cost of $118,300; and the work was placed in the continuing-contract class. This total amount has been appropriated.

The total expenditures to June 30, 1909, were $256,873.48.

The river had been well cleared of snags from the mouth to the Wilmington, Columbia and Augusta Railroad bridge, 103 miles, and less thoroughly snagged between the bridge and Cheraw, 48,466 snags, etc., having been removed since June 30, 1884.

As nearly as could be determined by the records, about $78,919.13 had been expended in originally clearing the river of snags and in preliminary examination and survey made in 1900, $104,793.28 in dredging, and about $73,161.07 in maintenance.

The expenditures during the year were for operation of dredge and snag boats, for prosecuting the improvement, and for maintenance in the removal of 142,445 cubic yards of dredged material and 3,733 obstructions.

About 99 per cent of the approved project for the upper river has been completed up to June 30, 1909. The contemplated depth (3½ feet) has been attained on the upper portion of the river.

The appropriation recommended will be applied to redredging and snagging for maintenance of the improvement from the mouth of the river up to Cheraw.

At mean low water 8 feet can be carried to Smiths Mills, 52 miles above the mouth, and about 3½ feet to Cheraw, the head of navigation, 167 miles above the mouth.

The usual variation in water level is 16.4 feet at Smiths Mills and 34.2 feet at Cheraw.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	62,344	$1,367,330	1900	154.727	$2,645,560
1892	92,471	1,401.038	1901	188,912	2,811,080
1893	94,661	1,166,874	1902	152,008	1,328,970
1894	91,025	1,169,070	1903	153,014	1,338,759
1895	106,115	893,430	1904	162,566	1,507,181
1896	229,964	1,325,250	1905	148,869	1,618,551
1897	114,177	1,167,914	1906	175,250	1,751,475
1898	75,280	1,228,885	1907	229,898	1,957,388
1899	134,072	1,692,709	1908	48,690	1,559,543

The vessels engaged in traffic on this river are steamers of 400 tons and less, seagoing schooners, pole boats, rafts, etc. No new line of transportation was established during the year.

One steamer which formerly ran to Cheraw was discontinued.

For references to examinations and surveys, see page 249, Annual Report of the Chief of Engineers for 1904.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1908, balance unexpended		$42,387.62
Receipts, account of sales		19.96
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		52,407.58
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$10,119.72	
For maintenance of improvement	23,841.38	
		33,961.10
July 1, 1909, balance unexpended		18,446.48
July 1, 1909, outstanding liabilities		1,119.57
July 1, 1909, balance available		17,326.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix N 3.)

4. Winyah Bay, South Carolina.—This large bay is connected with the ocean by a passage between the shores of North and South islands 2½ miles long, 1 mile wide at the bay, three-fourths mile wide at the gorge, and 1¼ miles wide at the ocean, or southeasterly, end of North Island. Through the passage, which trends north-northwest and south-southeast, there was a bold channel 36 feet deep at the bay, retaining a depth of not less than 20 feet until about 3,000 feet southerly from the end of North Island and of not less than 15 feet to a point about 1 mile south of the island, where the channel divided into two. One of these two channels, known as Main channel, continued 3½ miles farther, through extensive shoals, to the 18-foot contour in the ocean. This channel was south-southeast and in alignment with the main channel through the straits. The other, known as Bottle channel, after flowing about 2,500 feet southeasterly, 1,500 feet easterly, and about 3,000 feet northeasterly, reached the 18-foot contour in the ocean at a distance of about 1½ miles in a direction from the point of separation from the main ship channel almost at right angles with the direction of that channel and of the channel through the passage. At mean low water the depth on the crest of the bar was variable in both channels and about 7 to 9 feet in Main channel and 6 to 8 feet in Bottle channel. The mean range of tide is 3½ feet.

The present project, adopted in 1889, provides for the construction of two jetties, springing, respectively, from North and South islands and converging toward the bar, the jetties to consist of mattress foundation and a superstructure of large riprap stone raised to a height of 6 feet above mean low water, the south jetty to extend due east across the bar and the north jetty to converge toward it, so as to produce the necessary contraction on the bar. The depth to be secured is 15 feet at mean low water. The river and harbor act of June 3, 1896, authorized the completion of the work under continuing-contract system, at a cost not exceeding $1,996,250, in addition to the $20,000 appropriated by the act. The entire amount has been appropriated by sundry civil acts since that date. The project was extended by the river and harbor act approved June 13, 1902, to permit dredging at the shoal places in Winyah Bay, between the entrance and the city of Georgetown, S. C., over which the least channel depths might at any time be less than at the entrance to the bay, provided that the expenses of this dredging, added to that of improving the entrance to the bay, should not exceed the total amount authorized under the continuing-contract system.

The total expenditures to June 30, 1909, were $2,491,909.33, of which $428,750 was appropriated prior to June 3, 1896. Of this amount $6,252.36 was derived from miscellaneous sources, such as rent of dredge, auction sales, etc. For maintenance, $93,791.79 has been spent. The jetty work, which since June 3, 1896, had been under a continuing contract, had been completed. The north jetty extends a distance of 11,139 feet from the shore end, with crest from 4½ to 6 feet above mean low water, except the outer 100 feet, which is submerged. The south jetty extends a distance of 21,051 feet from the shore end, with crest at heights varying from 10 feet above mean low water at the inner end to nothing at the outer end. The stone superstructure has practically no top width. A stone mound, 50 feet long, 30 feet wide, and 12 feet above low water had been constructed to mark the outer end of the south jetty. The seagoing suction dredge *Winyah Bay* has been built, and this dredge and the similar dredge *Charleston* have removed 1,553,271 cubic yards of material from the entrance channel and 1,179,274 cubic yards of material from the eastern channel in upper Winyah Bay and Sampit River shoal. Spur dikes have been built to protect the South Island beach. A mud dike has been built from the high land on South Island to the high land near the Santee River to prevent the tides from cutting around the shore end of the south jetty, and the stonework of the jetty has been extended about 2,600 feet by a work of sheet piling covered with mud to connect with this dike.

The approved project was practically completed by June 30, 1909. Slight shoaling has occurred during the year in portions of the channel where the depth is slightly less than 15 feet; these shoal places will be removed during the coming fiscal year.

The appropriation recommended will be applied to dredging for maintenance of the improvement.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	261,370	$8,071,600	1901	247,989	$8,457,906
1892	271,986	....	1902	387,471	9,310,682
1893	268,640	....	1903	368,502	9,359,581
1894	293,822	....	1904	369,774	9,546,843
1896	171,059	6,228,350	1905	363,916	10,401,879
1897	149,374	5,817,950	1906	392,770	10,139,751
1898	125,003	5,587,880	1907	382,915	9,432,575
1899	120,587	6,337,853	1908	283,470	8,078,583
1900	129,639	6,749,433			

The vessels using the entrance channel are steamers of 1,850 tons and less and sailing vessels of various kinds. The freight carried is principally lumber, naval stores, and general merchandise. There are three lines of steamships plying between Georgetown and northern ports. The water rate on lumber, the chief export, had decreased from $5.50 per thousand feet B. M. in 1892 to $4.12½ in 1905, but it has since advanced to $6.

For references to examinations and surveys see page 250, Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended		$48,339.81
Receipts, account of sales, etc		65.29
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		63,405.10
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$24,615.40	
For maintenance of improvement	24,381.38	
		48,996.78
July 1, 1909, balance unexpended		14,408.32
July 1, 1909, outstanding liabilities		1,720.26
July 1, 1909, balance available		12,688.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix N 4.)

5. *Mingo Creek, South Carolina.*—To June 30, 1897, $17,000 had been expended on improvement to provide steamboat navigation up to Williams Landing and pole-boat navigation at high water up to the head of navigation by snagging and clearing the banks.

Deterioration having occurred, the sum of $300 was allotted from the emergency appropriation provided by the river and harbor act of March 2, 1907, of which $257.75 had been expended during the fiscal year 1908, for removing the worst obstructions to navigation.

No work was done during the past year. The small amount available was held for removing obstructions blocking or seriously interfering with navigation.

It is proposed to apply the appropriation recommended to snagging to maintain the channel.

July 1, 1908, balance unexpended	$42.25
July 1, 1909, balance unexpended	42.25
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	1,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N 5.)

6. *Santee, Wateree, and Congaree rivers, and Estherville-Minim Creek Canal, South Carolina.*—(*a*) *Santee River and Estherville-Minim Creek Canal.*—This river in its original condition was considerably obstructed at all stages of water by sunken logs and snags.

Its bar entrance was narrow, crooked, and shifting, with only about 4 feet of water at low tide, and so situated as to be difficult and expensive to improve.

The original project, adopted in 1880, contemplated providing an outlet for the river into Winyah Bay by constructing a canal from the river through Mosquito Creek into the bay. On this project there was expended $99,750.

The present project, adopted in 1889, contemplates providing a more satisfactory outlet into the bay by cutting a canal 70 feet wide and 6 feet deep at mean low water from the Estherville plantation to Minim Creek and for snagging the entire river. The estimated cost is $350,000, not including the amount expended under the original project.

The total expenditures under the present project to June 30, 1909, were $241,902.26, of which about $57,316.52 was for maintenance; of this, $32.50 was derived from sales at auction, etc. All the expenditure during the year was for maintenance, and consisted of the removal of 34,024 cubic yards of material and 54 stumps and logs from the canal, widening and deepening same. The first cut of the canal had been made entirely through, and this had been widened through a portion of its length. From the Santee River proper 1,818 obstructions had been removed.

The approved project is about 84 per cent completed.

Except at the Winyah Bay end, where on account of the softness of the banks the width has been reduced to 40 feet, the canal is 50 feet wide and 6 feet deep. The mean rise of tide at the canal is about 3½ feet. The least available depth in Santee River is about 4 feet at low water. The usual variation in water level at the Atlantic Coast Line bridge, about 54½ miles above the mouth, is about 19 feet, and at its junction with the Wateree and Congaree rivers, 143 miles above the mouth, about 20 feet. The river is navigable its entire length.

During the year the construction of a suction dredge was completed, for which the appropriation for this stream bears a part of the cost. For this there was an expenditure of $4,217.67. For dredging in the canal $10,784.21 was expended.

The appropriation recommended will be applied to widening the Estherville-Minim Creek Canal, and to removing obstructions from Santee River.

The additional work proposed is necessary to make the improvements available and for extending the benefits.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	100,255	$2,743,000	1900	179,090	$2,622,200
1892	110,523	2,775,800	1901	204,375	1,809,000
1893	124,182	2,679,600	1902	215,600	1,882,500
1894	115,428	2,375,000	1903	220,900	1,840,000
1895	117.690	2,224,800	1904	242.800	1,662.500
1896	134,135	2,204.600	1905	329,350	1,485,000
1897	134,206	2,159,940	1906	427,300	1,830,000
1898	112,205	2,203,800	1907	474,750	1,735,000
1899	154,327	2,679,100	1908	70,590	1,172,169

The vessels using the river and canal are steamers of from 10 to 500 tons, small sailing craft, pole boats, rafts, etc.

For references to examination and surveys and other information concerning the work see page 252, Annual Report of the Chief of Engineers, 1904.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1908, balance unexpended		$21,132.12
Receipts, account of sales		76.05
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,600.00
		26,808.17
June 30, 1909, amount expended during fiscal year:		
Transferred to allotment for Congaree River	$5,000.00	
For maintenance of improvement	15,001.88	
		20,001.88
July 1, 1909, balance unexpended		6,806.29
July 1, 1909, outstanding liabilities		27.60
July 1, 1909, balance available		6,778.69
Amount (estimated) required for completion of existing project		109,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*b*) *Wateree River.*—In its original condition this stream had a low-water depth of from 3 to 4 feet from its mouth, 67 miles, to Camden. The lower 14 miles was completely blocked at all stages of water by logs, snags, etc., and at moderate stages by the bridges of the South Carolina and the Wilmington, Columbia and Augusta railroads, then without draw spans; thence to Camden navigation was possible, but dangerous, except during high water. Its commerce was practically nothing.

The present project of improvement, adopted in 1881, provides for safe and unobstructed 4-foot navigation for steamers from Camden to the mouth, at an estimated cost of $60,000.

The appropriation of September 19, 1890, completed the estimate for the project, but appropriations have since been made for maintenance. The work is one of snagging and dredging, and as snags are continually lodging, it is not susceptible of completion. Snagging work should be done annually in order to keep the channel open.

The total expenditures to June 30, 1909, were $140,699.45. To June 30, 1900, the river had been kept fairly clear of obstructions from the mouth to Camden. Work was suspended in 1899, and was resumed in May, 1907, a snag boat having been built for this stream. All the expenditures during the year were for maintenance.

Snagging was done during the year and a total of 1,871 obstructions were removed.

Toward the construction of a suction dredge an expenditure of $4,100 was made under contract for machinery; for machinery for a snag boat there was expended $8,665.25 under contracts.

---

[a] See consolidated money statement on page 329.

The appropriation recommended will be applied to snagging and dredging for maintenance of the improvement.

The additional work proposed is necessary to make the improvement available.

So far as known the available depths now existing do not differ greatly from the original depths. The usual variation in water level is about 17 feet at a point about 4 miles above the mouth, and about 28.5 feet at Camden, 67 miles above the mouth.

The river is navigable from the mouth to Camden.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	1,005	$51,210	1900	93,024	$155,000
1892	2,244	86,040	1901	10,417	50,000
1893	6,242	117,729	1902	42,575	92,500
1894	18,075	94,334	1903	41,050	87,000
1895	21,697	127,565	1904	15,600	29,700
1896	35,002	233,525	1905	22,000	41,000
1897	43,770	202,800	1906	16,200	81,000
1898	83,568	274,050	1907	56,400	564,000
1899	109,170	272,200	1908	35,720	182,669

Rafting is the only business done on this river. No new line of transportation was established during the year.

For references to examinations and surveys see page 253, Annual Report of the Chief of Engineers, 1904.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1908, balance unexpended	$46,042.98
Receipts, account of sales	9.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909	14,300.00
	60,352.49
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	39,242.43
July 1, 1909, balance unexpended	21,110.06
July 1, 1909, outstanding liabilities	5,217.04
July 1, 1909, balance available	15,893.02
July 1, 1909, amount covered by uncompleted contracts	1,005.97
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

(*c*) *Congaree River.*—In 1886 this stream in its original condition had a low-water depth of 3 to 4 feet from its mouth to the railroad bridge at Columbia, thence 1 foot low-water depth 2 miles farther to its head. The navigation of the lower 49 miles was blocked at all stages of water by the South Carolina Railroad bridge and by sunken logs, snags, and overhanging trees. The navigation of the remaining 2 miles was prevented by swift currents and numerous rock ledges and bowlders. Its commerce was nothing.

---

[a] See consolidated money statement on page 329.

The project of improvement adopted in 1886 proposes to secure a thoroughly cleared 4-foot navigation over the lower 49 miles at all stages of water and a cleared channel through the rock ledges and bowlders above at an estimated cost of $54,500. This project was modified in 1899, when a lock and dam was authorized for extending steamboat navigation through these ledges and bowlders in the river from Gervais Street Bridge, Columbia, to Granby. The open-channel work above Granby was thus eliminated for the time being. Appropriations for the lock and dam were made, amounting to $250,000, $25,000 of which, by authority of Congress, was allotted for the open-channel work. The lock and dam had been completed with the $225,000, and considerable work done in clearing the channel between the lock and the city of Columbia.

The river and harbor act of March 2, 1907, contained the following proviso in appropriating for this stream: "And the limits of the improvement of the Congaree River shall be extended to include that part of the said river included in the project from Gervais Street Bridge, Columbia, to Granby, South Carolina." Under this authority the work on the entire length of the river will be prosecuted under allotments from appropriations for improving Santee, Wateree, and Congaree rivers and the Estherville-Minim Creek Canal, South Carolina.

In 1905 a survey of the river between the lock and dam and the mouth of the river, made to determine what additional work was required to form a 4-foot channel at all stages of water, showed that in addition to clearing the river of obstructions by snagging, dredging was also required, and that the estimated cost of the project should be increased accordingly. To obtain and maintain this channel would cost $20,000 a year for four years, after which a yearly expenditure of $10,000 would probably suffice.

The total expenditures for open-channel work to June 30, 1909, were $132,241.80. The channel had been thoroughly snagged from the mouth to Granby, 2 miles below Columbia. A total of 17,057 obstructions had been removed below Granby. Dredging had been carried on, removing 157,143 cubic yards of sand and pebbles. Work had been in progress of clearing the channel above the lock. As nearly as can be determined from the records about $70,855.14 has been applied to work of maintenance.

Snagging was done during the year and a total of 707 obstructions were removed. During the year approximately 730 tons of rock was removed. This rock excavation made it possible for steamers to land at the foot of Senate street, Columbia, S. C.

Under allotments from the emergency appropriation provided by the river and harbor act of March 2, 1907, made November 12, 1908 ($5,125), and February 17, 1909 ($1,800), derrick *A* was operated forty-six days in removing snags, dragging channel, dredging stone from the rock cut, etc., to restore the channel depths above the lock; about 393 tons of stone were removed; the dredge *Congaree* removed from the channel 134,462 cubic yards of sand, and a 6-inch pump was operated eighteen days pumping sand from the channel. The expenditures from these allotments were $5,843.66, and were rendered necessary by the extraordinary flood in the Congaree River which occurred in August, 1908.

It is thought that to secure safe and certain navigation of the portion of the river above Granby it will be necessary to reconstruct the dam, so as to raise the pool level 2 feet, at an estimated cost of $50,000.

The appropriation recommended will be applied to work of improvement in removing bars and obstructions between the mouth and Columbia.

The usual variation in water level at a point 2 miles above the mouth is about 24.3 feet and at Columbia about 33.2 feet. Columbia is the head of navigation and is distant 51 miles from the mouth.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	2,401	$47,840	1900	121,363	$197,000
1892	3,686	62,025	1901	14,583	70.000
1893	2,781	71,125	1902	58,075	128.500
1894	7,974	40,760	1903	114.310	271,400
1895	8,993	45,700	1904	43,035	93,900
1896	18.307	178,900	1905	34,350	252,000
1897	40,857	110,100	1906	35,522	821,100
1898	81,362	201,700	1907	73,833	1,234,000
1899	88,696	191,700	1908	22,122	506,994

A steamboat line between Columbia and Georgetown, S. C., has been established. Connection is made at Georgetown with steamers for New York, Baltimore, and Charleston. Boats are now landing at foot of Senate street, Columbia, S. C., the present head of navigation. A reduction of from 22 to 30 per cent in freight rates from Columbia to New York (difference between rail and water transportation) has been effected by the improvement.

For preliminary examination and survey, see page 1140, Annual Report of the Chief of Engineers for 1885. For outline map of river, see page 1194, Annual Report of the Chief of Engineers for 1889.

For project for construction of lock and dam, see page 1182, Annual Report of the Chief of Engineers for 1896.

Reference to report on examination made in compliance with the river and harbor act of March 2, 1907, will be found on page 323 of Annual Report of the Chief of Engineers for 1908.

July 1, 1908, balance unexpended	$26,487.33
Receipts, account of sales	9.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909	28,100.00
Transferred from allotment for Santee River	5,000.00
Allotment (emergency appropriation of March 2, 1907):	
November 12, 1908	5,125.00
February 17, 1909	1,800.00
	66,521.84
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	36,572.79
July 1, 1909, balance unexpended	29,949.05
July 1, 1909, outstanding liabilities	847.70
July 1, 1909, balance available	29,101.35
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

---

[a] See consolidated money statement on page 329.

CONSOLIDATED.

July 1, 1908, balance unexpended	$93,662.43
Receipts, account of sales	95.07
Amount allotted from appropriation by river and harbor act approved March 3, 1909	48,000.00
Allotted (emergency appropriation of March 2, 1907):	
November 12, 1908	5,125.00
February 17, 1909	1,800.00
	148,682.50
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	90,817.10
July 1, 1909, balance unexpended	57,865.40
July 1, 1909, outstanding liabilities	6,092.34
July 1, 1909, balance available	51,773.06
July 1, 1909, amount covered by uncompleted contracts	1,005.97
Amount (estimated) required for completion of existing project	109,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	64,000.00

(See Appendix N 6.)

7. *Operating and care of lock and dam across Congaree River, near Columbia, S. C.*—This service is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation, under the provisions of section 4 of the river and harbor act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act approved March 3, 1909.

The operation and care of the lock and dam across the Congaree River have been provided for by allotments from this appropriation since April 7, 1906. The expenditures during the fiscal year were $10,480.68; the total expenditures have been $21,284.19.

A special emergency allotment of $4,175 was made February 18, 1909, to repair damages caused by extraordinary flood of August, 1908.

(See Appendix N 7.)

8. *Inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville.*—These waterways consist of a series of creeks, sounds, rivers, and bays, which afford a route sheltered for the most part from the sea by the numerous islands which form the outer coast line. The route is tidal throughout, the range of tide varying from about 4.6 to 5.3 feet. It is now obstructed by a number of shallow reaches and narrow, crooked passages, particularly at points where the tides meet. The passage across Bulls Bay, besides being very shallow, is much exposed. The present commerce is comparatively small, as only very small vessels can get through without excessive delays.

The plan of improvement adopted in 1902 provides for a channel between Charleston Harbor and opposite McClellanville 4 feet deep at mean low water and 60 feet bottom width, at an estimated cost of $125,290. The project was modified by the river and harbor act of March 2, 1907, to provide for a branch of the channel to Morrisons Landing in McClellanville. The new channel will partly follow the present channels and will partly lie in cuts across the marsh to avoid crooked and dangerous sections. It will pass to the northward of

Bulls Bay. A revised estimate made during the fiscal year 1908, based upon work already done, shows that to complete the improvement there will be required $66,000 in addition to the amount originally estimated.

The total expenditures to June 30, 1909, were $122,052.01. A contract was let in 1905, under which there was removed 158,441 cubic yards; a second contract was made during the present fiscal year for continuing the work, and under this there has been removed 297,264 cubic yards, making a total of 455,705 cubic yards, which is about 64 per cent of the approved project.

The appropriation recommended will be applied to prosecution of the improvement by dredging between Grahams Creek and McClellanville.

The improvement can have no effect on freight rates until the project shall have been completed.

For references to reports of examinations and surveys, see page 256, Annual Report of the Chief of Engineers for 1904.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1903	33,344	$579,520	1906	49,440	$797,747
1904	39,064	573,770	1907	36,230	921,675
1905	58,421	608,761	1908	32,388	1,146,240

July 1, 1908, balance unexpended	$47,805.28
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	52,805.28
June 30, 1909, amount expended during fiscal year, for works of improvement	44,567.29
July 1, 1909, balance unexpended	8,237.99
Amount (estimated) required for completion of existing project	66,000.00
Amount that can be profitably expended in fiscal year ending June 30 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	66,000.00

(See Appendix N 8.)

9. *Charleston Harbor, South Carolina.*—There were originally four channels across the bar, the deepest having about 12 feet depth, at low water. Commerce was then using the Pumpkin Hill channel, about 3 miles south of the present jetty channel. Where the present jetty channel is situated there was then the Swash channel, with a best depth of 10½ feet of water, too crooked for safe use. The natural channels were shifting in position and variable in depth.

The original project, adopted in 1878, provided for establishing and maintaining, by means of two jetties and auxiliary dredging, a low-water channel of not less than 21 feet depth across the bar. The Swash channel was selected for improvement. The estimated cost was $3,000,000.

In 1888 it became necessary to modify the height of the crest line of the jetties and to revise the estimate. This increase in the estimate was largely due to the fact that money had been appropriated so slowly that reasonable contract prices could not be obtained. The annual appropriation up to that time had been only 5½ per cent of the original estimate. In the revised project the jetties were increased in height and length, but no change was made in their position or distance apart. The revised estimates were $4,380,500 if the jetties were brought up to low-water level throughout, and $5,334,500 if brought up 3 feet higher. The former estimate was adopted by Congress in the river and harbor act approved July 13, 1892.

The present project, adopted by the river and harbor act approved March 3, 1899, provides for obtaining a channel at the entrance to Charleston Harbor not less than 26 feet deep at mean low water (mean range of tide about 5.2 feet) and 600 feet wide, by constructing a large seagoing suction dredge, at a cost not exceeding $150,000, and operating her, together with the existing dredge *Charleston*, for three years. The estimated cost of constructing the new dredge and operating it, as above, was $285,000. Of this amount $175,000 had been appropriated prior to the enactment of the river and harbor act of June 13, 1902, which made available an additional sum of $208,000, increasing to $383,000 the amount authorized for the project for the new dredge and its operation. The entire amount authorized has been appropriated.

The total expenditures to June 30, 1909, were $4,653,057.59, including about $2,500 expended at Sullivans Island and $10,000 at Mount Pleasant; of this sum $7,823.23 was derived from miscellaneous sources, such as rental of dredge and auction sales. Of this amount, $4,640,557.59 had been expended on the original projects and on maintenance.

Dredging during the year provided the full project width. A good channel exists of not less than 26 feet at mean low water and at least 600 feet wide throughout the whole length of the improved portion, although a slight shoaling occurred in the outer portion during the year. The mean tidal range is 5.2 feet.

The operations during the year were for maintenance.

The river and harbor act of March 3, 1905, authorizes the Secretary of War, in his discretion, to cause the new dredges employed on this work to be utilized, at such times as they are not employed in dredging on the outer bar, for dredging in the channels between said outer bar and the city of Charleston.

For references to examinations and surveys and to projects see page 257, Annual Report of the Chief of Engineers for 1904.

COMMERCIAL STATISTICS.

Foreign commerce.

Year.	Aggregate registered tons.	Value.	Year.	Aggregate registered tons.	Value.
1889	211,203	$16,744,951	1899	174,525	$6,385,168
1890	224,962	16,041,397	1900	150,631	11,170,910
1891	274,149	23,110,664	1901	141.003	5,276,757
1892	169,379	11,829,607	1902	219,069	7,095,294
1893	193,336	11,940,129	1903	142,196	5,237,119
1894	208,169	11,560,372	1904	146,966	6,100,295
1895	140,938	10,586,326	1905	106,351	3,337,038
1896	158,325	11,785,846	1906	132,400	4,165,567
1897	226,750	12,106,763	1907	174,219	6,036,866
1898	214,180	10,956,250	1908	187,044	6,969,606

Commerce through Charleston Harbor, ocean entrance.

Year.	Total imports and exports.	Value.
	Tons.	
1901	784,812	$29,454,515
1902	822,845	34,746,907
1903	685,903	47,659,427
1904	880,596	49,994,894
1905	858,016	51,631,040
1906	835,360	56,301,096
1907	722,338	56,138,444
1908	651,232	61,444,244

Regarding effect on freight rates since improvement began in 1878, the only change that seems due to the improvement is a lowering of about 12½ cents per ton on business done by coastwise sailing vessels.

The additional work proposed is for maintenance.

July 1, 1908, balance unexpended	$17,312.87
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	42,312.87
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	12,047.23
July 1, 1909, balance unexpended	30,265.64
July 1, 1909, outstanding liabilities	3,247.09
July 1, 1909, balance available	27,018.55

(See Appendix N 9.)

10. Removing sunken vessels or craft, obstructing or endangering navigation.—For making examination of the wreck of the steamer *Housatonic*, near the entrance to Charleston Harbor, with a view to its removal, allotment of $800 had been made June 1, 1908. During July the examination was made at a cost of $395.85 and the removal of the wreck recommended at an estimated cost of $12,000. This sum was allotted September 14, 1908, and contract made January 18, 1909, in the sum of $3,240; contract was approved February 16, 1909. The wreck was removed by breaking it up with dynamite and raising the broken pieces. About 4 tons of old iron was so removed. The expenditures during the fiscal year were $826.57; none were made during the preceding year. The contractor had not been paid.

Cambusdoon.—The hulk of the old bark *Cambusdoon*, which was floating in the harbor at Charleston, a menace to navigation, was removed at a cost of $416.75.

Leonora.—For making an examination of a wreck in Beaufort River, South Carolina, an allotment of $50 was made August 5, 1908; the examination was made at a cost of $34.69; the wreck was found to be that of a small schooner, the *Leonora*, and its removal at an estimated cost of $700 was recommended. Allotment for this purpose was made September 28, 1908. Contract was made for the removal of the wreck in the sum of $400. The wreck was removed and placed in a small creek where it would not interfere with navigation. Expenditures for this work were $440.83.

Wreck in Great Pedee River, South Carolina.—For the removal of a sunken gunboat in Great Pedee River, South Carolina, an allotment of $2,000 was made October 19, 1908. No work had been done on account of high stage of water. No expenditures were made.

Sunken caisson, Port Royal Naval Station, S. C.—On December 9, 1908, allotment of $2,000 was made. On March 10, 1909, a further allotment of $2,600 was made for the removal of an old caisson which had been sold at the Port Royal Naval Station and which the purchaser had partly dismantled and abandoned, after sinking at the naval station wharf. This wreck was removed during the months of January and February and deposited where it would not interfere with navigation. The expenditures for this were $4,305.26.

(See Appendix N 10.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT, APPROVED MARCH 2, 1907.

Reports dated April 18, 1907, and June 5, 1908, on preliminary examination and survey, respectively, of *Great Pedee River, South Carolina, from Georgetown to Pedee Station,* required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1162, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $53,000 is presented.

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT, APPROVED MARCH 3, 1909.

Report dated April 22, 1909, on preliminary examination of *Waverly Creek, South Carolina, from its mouth to Waverly Mills,* required by the river and harbor act of March 3, 1909, was duly submitted by the district officer. It was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and was transmitted to Congress and printed in House Document No. 72, Sixty-first Congress, first session. The locality is not considered worthy of improvement by the General Government.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SAVANNAH, GEORGIA, DISTRICT.

This district was in the charge of Col. Dan C. Kingman, Corps of Engineers, division engineer, Southeast Division, having under his immediate orders since April 6, 1909, Capt. W. P. Stokey, Corps of Engineers.

1. Savannah Harbor, Georgia.—This covers the estuary of the Savannah River from the upper limits of the city of Savannah to the ocean bar, a distance of 26 miles, measured along the channel. In 1873 the channel was in places not more than 9 feet deep at mean low water.

The first appropriation for the improvement of this harbor was made in 1826, and had reference to the removal of natural and artificial obstructions, but the first comprehensive plan of improvement is dated February 11, 1853. Another, for the removal of obstructions, is dated about 1871.

A later plan of improvement is dated August 28, 1873, and was supplemented March 19, 1879. It contemplated the establishment of a channel from the city to the sea, practicable at high tide for vessels drawing 22 feet of water. This project was replaced by an enlarged one (January 16, 1882, Annual Report of the Chief of Engineers for 1882, Appendix J 4) contemplating the same channel depth. The amount expended under these projects up to June 30, 1890, was $1,850,528.53.

The project in force up to June 13, 1902, adopted in 1890, providing for a mean high-water depth of 26 feet from the city to the sea, is printed as part of Appendix O, Annual Report of the Chief of Engineers for 1890. The channel depth contemplated by it was reported as having been obtained at the end of the fiscal year 1896. While the project depth was literally obtained, the channel was very crooked and of much less than the project width.

A supplemental plan of improvement was submitted December 7, 1894, providing for a detached extension of the Oyster Bed training wall, for the purpose of sheltering the anchorage in Tybee Roads, as well as for protecting the ship channel over the outer part of Tybee Knoll against the destructive action of heavy storms. This project, which is printed as part of Appendix M 1 of the Annual Report of the Chief of Engineers for 1895, was authorized by act of Congress of June 3, 1896, its estimated cost being $992,250. This work was never finished, the contract having been annulled in 1899, when less than one-third of the proposed work was accomplished. The same act authorized the completion of work for improving the inside route from Savannah, Ga., to Beaufort, S. C., at an additional cost of $106,700, and dredging for maintenance in Savannah Harbor, and the sum of $1,005,000 was appropriated to complete these works.

The amount expended under the project of 1890 up to June 30, 1896, was $3,460,049.99, of which $974,504.88 was for dredging and $2,356,720.10 for contraction work. There had previously been expended $1,850,528.53, giving a total of $5,310,578.52. Between June 30, 1896, and June 30, 1902, $712,918.84 was expended on the modified 26-foot project, of which $84,850.98 was for maintenance.

From the time of the reported completion of the project of 1890, in July, 1896, until June 30, 1902, extensive dredging was done, both for maintenance and as part of the modification of the project.

On June 13, 1902, Congress adopted a project which provided for the establishment of a channel from the Old Waterworks (2 miles above Savannah) to the ocean, 28 feet deep at mean high water, with bottom widths of 350 to 500 feet, to be accomplished by dredging and the raising of all existing training walls between Savannah and Tybee Roads. It also provided for the construction of mooring dolphins at two points in the harbor—the "Bight" and Venus Point. The estimated cost of the work was originally $1,567,791. This amount was increased by $210,000 by the act of Congress approved March 3, 1905. This project will be found printed in House Document No. 123, Fifty-sixth Congress, second session, and also in the Annual Report of the Chief of Engineers for 1901, page 1723.

The river and harbor act of March 3, 1905, called for a resurvey of Savannah Harbor, Georgia, with plans and estimates of cost, with a view to securing a channel to the sea 26 feet deep at mean low water. The survey was made and the plans and estimates prepared, and will be found printed as House Document No. 181, Fifty-ninth Congress, first session. This project was not adopted by Congress in its entirety, but the river and harbor act of March 2, 1907, appropriated $300,000, and in addition authorized continuing contracts in the sum of $700,000 (all of which has now been appropriated) for prosecuting the improvement and for maintenance, in accordance with the plans of the Board of Engineers for Rivers and Harbors, as set forth in the House document just referred to. The recommendation of the Board was that the improvement should be undertaken in a tentative manner, with the object of first securing across the bar the maximum depth within the limits fixed by Congress that can be maintained by dredging alone, a 21-foot channel first to be dredged and then gradually deepened until the limit fixed by economy of maintenance is reached. The act authorized such raising and extending of dikes, jetties, and other contraction works as may be necessary at a cost not to exceed $300,000, and the purchase of a pumping dredge of the stationary type at a cost of $125,000. The increased depth gained upon the bar is to be carried up the river by dredging at such a rate as will insure the same navigable depth as is maintained on the bar.

The amount expended under the 28-foot project (mean high water) up to June 30, 1908, was $1,643,282.29, of which $214,043.28 was for maintenance. The sum of $672.25 was derived from sales of government property and deposited to the credit of the appropriation.

The expenditures to June 30, 1909, under the tentative project adopted March 2, 1907, amounted to $633,404.34, of which $124,103 was for maintenance, and $119,676.21 was disbursed by Maj. J. C. Sanford and Maj. Herbert Deakyne, Corps of Engineers, on account of the construction of the dredge provided for by the project. The sum of $8 was received from the sale of blueprints of the plans of the dredge, and $94.28 from sales of condemned property. Details of the dredge construction will be found in Appendix H 9, Annual Report of the Chief of Engineers for 1908, and in Appendix H 10 of this report. The total amount expended for the improvement of Savannah Harbor up to June 30, 1909, was $8,300,183.99. A total of $1,075.94 was received from sales of condemned property and of blueprints. The sum of $500 was deposited to the credit of the appropriation by the clerk of the United States circuit court for the southern district of Georgia. The expenditure of this sum has secured and maintained the various objects had in view in projects heretofore stated, and with the net result of securing a navigable channel not less than 22 feet deep at mean low water from the wharves of Savannah to Tybee Roads, and not less than 24 feet thence to the sea.

The mean rise and fall of the tide on the outer bar is 7 feet; on Tybee Knoll, 6.8 feet; and at the upper limit of the harbor, 6.4 feet.

During the fiscal year the three United States dredges removed a total of 1,048,846 cubic yards of material for the advancement of the project. Of this, about 110,000 cubic yards was upon the ocean bar, 707,000 cubic yards in the roads, 61,000 cubic yards on the Knoll, and 171,000 cubic yards on the middle ground near the quarantine station. Ten thousand one hundred and forty-one and forty-four one-hundredths tons of rock and 912.15 cubic yards of brush fascines were used by D. Power & Co. in completing their contract for raising dikes and training walls, and 14,969.74 tons of rock were used by Roderick G. Ross in his contract for raising and strengthening the North Long Island and Cockspur Island training walls. Work under this last-named contract is still in progress. The Simons-Mayrant Company completed their contract for reopening the Screvens Ferry route by dredging, at a total cost of $2,574.40. They also completed supplementary contract for dredging in Mud River Cut, where 5,624 cubic yards of material were removed. These things, i. e., the work at Screvens Ferry and Mud River Cut, form no part of the improvement of Savannah Harbor, but were rendered necessary in consequence of regulating works built in the harbor.

In addition to the above, the United States dredges removed 691,203 cubic yards of material from the river above quarantine station, depositing the same at Venus Point, from whence about 380,000 cubic yards had been pumped ashore at the close of the year. The remainder is still to be rehandled. This last dredging was primarily for the purpose of maintenance and was the only maintenance work that was done during the year, but it was found, by comparing the present condition in the river with that of three years previous, that a substantial advance has been made toward the 26-foot project (mean low water). As careful an adjustment as can be made between the two indicates that $57,591 worth of work has been done for maintenance during the year.

All of the money authorized for the tentative project has been appropriated, but it is not yet all expended. It will be, however, by the 30th of June, 1910. For a detailed report of what has been accomplished in this experiment, attention is invited to the report of the district officer, Appendix O 1, herewith.

Briefly, the results indicate very clearly that a channel 26 feet deep at mean low water can be readily secured, at a cost within the estimate, across Tybee bar and through the roads, and also that it can be maintained at very moderate expense, and that the 26-foot depth can be carried up the river to the upper limit of the city at a cost within the estimate given in the 1905 project. In short, that the project can be carried out within the original estimate and that it gives every promise of being reasonably permanent and easily maintained. It is estimated that it will cost $1,545,000, in addition to funds now available, to complete the project. It is recommended that the project be adopted with a view to its completion by the 30th of June, 1914, the appropriation to be made in four annual installments, the first three of $400,000 each and the last in an amount sufficient to make up the balance.

It is proposed to expend the balance on hand and the additional appropriation recommended in maintaining and carrying forward, as authorized, the general project of 1905, printed as House Document No. 181, Fifty-ninth Congress, first session, with only such slight modifications as to the extent of dikes and training walls to be raised and strengthened as experience may indicate to be desirable and necessary. The additional work proposed is for extension of benefits.

The estimate submitted for the fiscal year 1911 is for maintenance only, leaving it for Congress to decide to what extent it proposes to further prosecute the work of improvement at this locality.

In 1872 the tonnage of vessels arriving and clearing at Savannah Harbor was reported to be somewhat more than 1,000,000 and the total value of imports and exports about $34,000,000. In 1890 the total tonnage was reported to have increased about 2,000,000 and the value of imports and exports to $152,000,000. For the calendar year 1908 the total amount of freight received and shipped at the port was 3,899,361 tons, valued at $167,941,267. The commerce consists principally of naval stores, fertilizers, produce, iron, cotton, lumber, and general merchandise.

Attention is invited to a detailed discussion of the commerce of Savannah Harbor contained in Appendix O 1 of this report.

The effect of the improvement upon freight rates since 1896 has been a reduction of from 30 to 50 per cent, according to the nature of the commodity.

A list of Reports of the Chief of Engineers and executive documents, in which the various projects, examinations, surveys, maps, etc., are printed may be found on page 272 of the Annual Report of the Chief of Engineers for 1905. A map of the harbor, showing conditions on June 30, 1906, will be found in the Annual Report of the Chief of Engineers for 1906, opposite page 1192.

Reference to report on resurvey of the harbor required by the river and harbor act of March 3, 1905, will be found on page 311 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1908, balance unexpended		[a]$376,051.89
Amount received from sales of government property		57.38
Amount appropriated by sundry civil act approved March 4, 1909		400,000.00
		776,109.27
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$248,562.74	
For maintenance of improvement	57,591.00	
		[b]306,153.74
July 1, 1909, balance unexpended		469,955.53
July 1, 1909, outstanding liabilities		44,473.30
July 1, 1909, balance available		425,482.23
July 1, 1909, amount covered by uncompleted contracts		62,162.64
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		200,000.00

(See Appendix O 1.)

2. *Savannah River below Augusta, Ga.*—This river is navigable from Savannah to Augusta, Ga., a distance of 202 miles. Previous to improvement there were numerous shoals in the river, with less than 3 feet at summer low water, the other obstructions consisting of overhanging trees, snags, and sunken logs. The aggregate length

---

[a] Includes $12,306.36 for construction of dredge.

[b] Includes $6,974.57 for construction of dredge.

of river upon which there was less than 5 feet was about 9,800 feet, divided up into 10 shoals, and the controlling depth was about 2½ feet.

The original project, submitted December 22, 1880, provided for securing a 5-foot channel, 80 feet wide, by means of removal of snags, trees, sand bars, etc., and protection of banks, at a cost of $91,000.

Under this project there was expended, prior to operations under the existing project, $93,480.09.

The existing project, adopted in 1890, provides for the establishment of a navigable steamboat channel 5 feet deep at ordinary summer low water between the cities of Augusta and Savannah, to be accomplished by removing sand and gravel bars, regulating portions of the river, revetting caving banks, closing incipient cut-offs, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The total estimated cost of this improvement, in round numbers, was $332,000, on the supposition that funds would be regularly and adequately supplied, besides $3,000 to $5,000 annually for maintenance.

The amount expended upon the work under the existing project up to June 30, 1909, was $405,195.96 (of which $46,742.50 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $498,676.05.

A total of $655.77 has been received from sales of unserviceable property and deposited to the credit of the appropriation.

The work done under the present project has resulted in the removal of great numbers of snags and stumps from the river channel and the cutting of numerous overhanging trees on the banks. Sand bars have been removed by means of training dikes and shore protection at 11 localities. A great deal of work, however, remains to be done, principally in the upper 30 miles of the river, where there are sand shoals with only 3 feet of water over them. A great many snags also require removal.

All work done during the fiscal year was for maintenance and consisted of the following:

Two thousand one hundred and sixty-four snags and 154 stumps were removed from the channel and 95 logs and 3,198 overhanging trees cut on the banks of the stream. Temporary relief was rendered to navigation by the dragging of heavy anchors back and forth across Tweedys sand bar by the snag boat *Tugaloo*. Assistance was rendered by the snag boat to the river steamer *Two States*, which sunk in the channel at Augusta, the work done enabling the owners to raise the boat and prevent it becoming a total wreck and a serious obstruction to navigation. A sunken lighter which obstructed navigation was also removed. Repairs and alterations to the snag boat were in progress at the close of the fiscal year.

The proportion of the approved project accomplished up to June 30, 1909, was about 75 per cent.

At the close of the fiscal year the project depth of 5 feet can be carried from Savannah to Augusta, except at two or three places near Augusta, where the controlling depth at an ordinary stage of summer low water is 3 feet. The river very rarely goes below 3 feet and rises more than 30 feet in times of floods, frequently standing for long periods at several feet above summer low water. Existing training and shore protection dikes are in a generally fair condition, except in the case of those at Tweedys bar, some of which are in need of extension and repair.

In the upper 30 miles of the river the banks in many places cave more or less with every high freshet, and the problem of obtaining and maintaining the project depth has been treated in full in the report of the survey above referred to.

It is proposed to apply the available balance and additional appropriation recommended toward keeping the channel cleared of snags and similar obstructions, and in repairing existing training and shore protection dikes and constructing others where necessary. The additional work proposed is for extension of benefits.

Prior to the improvement the commerce was small, but its quantity unknown. The total commerce of the river during the calendar year 1908 amounted to 48,274 tons, valued at $5,425,800. It consists principally of cotton and cotton-factory products, naval stores, fertilizers, and general merchandise. There was also rafted down the river during 1908 about 15,000,000 feet b. m. of timber, valued at about $150,000.

The effect of the improvement upon freight rates has been a reduction of from 30 to 50 per cent, according to the nature of the commodity.

A list of Reports of the Chief of Engineers and of executive documents, in which projects of improvement, maps, etc., are printed, may be found on pages 274 and 275 of the Annual Report of the Chief of Engineers for 1905.

Report on examination and survey of the Savannah River, for 30 miles below Augusta, will be found printed as House Document No. 962, Sixtieth Congress, first session. Report on examination and survey of Savannah River at Augusta, ordered by the river and harbor act of March 3, 1909, will be submitted to Congress at its next session.

July 1, 1908, balance unexpended	$17,504.76
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	42,504.76
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	12,025.04
July 1, 1909, balance unexpended	30,479.72
July 1, 1909, outstanding liabilities	4,923.89
July 1, 1909, balance available	25,555.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O 2.)

3. Savannah River above Augusta, Ga.—This portion of the Savannah River is navigable only by pole boats from the locks, 7 miles above the city of Augusta, to Petersburg, a distance of 48 miles. In its original condition the river at low water was navigable only with great difficulty, on account of shallow water, obstructing logs, etc.

The original project of improvement, submitted February 8, 1879, provided for a 3-foot channel, 30 feet wide, from Augusta, Ga., to Trotters shoals and the removal of snags, trees, etc., to the Tugaloo River, at a cost of $45,000.

Under this project there was expended, prior to operations under the existing project, $39,000.

The existing plan of improvement, adopted by Congress July 13, 1892, provides for the establishment, between Petersburg and the locks, of a downstream channel 12 to 25 feet in width and navigable during ordinary summer low water for pole boats drawing 2 feet and of an upstream channel navigable for pole boats drawing 1.3 feet of water. This is to be obtained by removing logs and overhanging trees; excavating rock, sand, or gravel, and with excavated materials raising crests of ledges; constructing training walls, to increase flow of water through sluices. The total estimated cost is $33,000.

The total amount expended under the present project up to June 30, 1909, was $24,004.40, which, added to that previously expended, gives a total for this work of $63,004.40. No funds have been expended for maintenance.

The work accomplished under this project has given a downstream channel about 2 feet deep and an upstream channel of the project depth. In many places, however, these channels are difficult to navigate and are capable of greater improvement.

The proportion of the approved project accomplished up to June 30, 1909, was about 60 per cent.

Authority has recently been granted to a private company to construct a dam across the Savannah River about 20 miles above the dam at Augusta, to be 60 feet high and provided with locks of sufficient size to pass an ordinary river steamboat. The pool formed by this dam will drown out the principal shoal on that portion of the river now under improvement, and when this dam is completed and the lock ready for operation, a new survey should be made and a new project prepared to conform to the new conditions.

The work of the year was for improvement and consisted in the removal of 52 snags, 111 logs, and 52 cubic yards of loose rock from the channel and cutting 294 overhanging trees from the banks, and the placing of 440 cubic yards of rock in repairing existing dams.

It is proposed to apply the available balance and the additional appropriation recommended toward the removal of obstructions and the widening and deepening of the channel.

The additional work proposed is for extension of benefits.

In 1876–77 about 2,000 tons of freight went upstream and about 12,000 bales of cotton came down.

Complete figures for the commerce of 1908 was unobtainable for the reasons set forth in Appendix O 3. It is probable that such commerce did not differ greatly from the customary amount for the past eight years, which averaged 2,995 tons, valued at $169,780.

The commerce consists of cotton, grain, fertilizers, hay, cord wood, and general merchandise, and is carried on exclusively by pole boats.

The effect of the improvement has been to render navigation safer and easier, but it is impossible to determine whether it has caused any reduction in freight rates.

A list of reports of the Chief of Engineers and of executive documents containing the projects of improvement, maps, etc., may be found on page 276 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1908, balance unexpended	$2,710.83
June 30, 1909, amount expended during fiscal year, for works of improvement	1,715.23
July 1, 1909, balance unexpended	995.60
Amount (estimated) required for completion of existing project	8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for work of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O 3.)

4. Harbor at Darien, and Doboy bar, Georgia—(*a*) *Darien Harbor.*—This harbor is navigable from its mouth to the town of Darien, a distance of 13 miles.

In its original condition it was obstructed at seven points by shoals, with mean low-water depths of from 6½ to 10½ feet. Between the shoals there was nowhere less than 12 feet at mean low water.

There was expended on this harbor in 1879 for dredging $8,000, without any project having been recommended or adopted.

The project for the improvement of this harbor, adopted in 1885, contemplates the establishment of a navigable channel 12 feet deep at mean low water between Darien and Doboy at an estimated cost of $170,000. Work was not begun under this project until 1891. The total amount expended under it up to June 30, 1909, was $157,365.96 (of which $20,572.75 was for maintenance), which, added to the amount previously expended, gives a total for this work of $165,365.96. The work done under the present project has resulted in a navigable channel 12 feet deep at mean low water from Darien to Doboy. The project was reported as completed July 11, 1905.

No work was done during the fiscal year, no funds being available.

On June 30, 1909, the controlling depth in the harbor was 10 feet at mean low water, shoaling having occurred at several places since the project depth of 12 feet was obtained in July, 1905. The mean rise and fall of tide is from 6.5 feet at Darien to 7 feet at the entrance.

The additional work proposed is for maintenance only.

The total tonnage for 1878 was estimated at about 200,000 and the value of exports at between $600,000 and $700,000. The commerce consists almost entirely of timber, and in 1908 the total shipments amounted to 33,856,228 feet, valued at $501,312. In addition there was 55,485,000 feet rafted through the harbor to Sapelo and to Savannah. The local freight handled at the port during 1908 amounted to 3,000 tons, valued at $180,000.

The improvement of this harbor has rendered it possible to ship lumber from Darien, which before was impracticable, and has caused a reduction in freight rates of about 15 per cent.

A list of the Reports of the Chief of Engineers in which the project of improvement, history of the work, etc., are printed may be found on page 277 of the Annual Report of the Chief of Engineers for 1905.

By act of Congress approved June 13, 1902, this work was consolidated with Doboy bar, Georgia.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement	$10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*b*) *Doboy bar.*—In 1888, $5,795.40 was spent in harrowing and water-jet work on this bar without result. In its original condition there was about 12 feet at mean low water in the old channel, which was very crooked, so that the entrance was not much used.

The project for its improvement, adopted by act of Congress of March 3, 1899, provides for creating a channel by dredging 24 feet deep at mean high water and 300 feet wide, estimated to cost $70,000. The proposed channel is some distance north of the old channel.

The amount expended under the project up to June 30, 1909, was $49,134.04, which, added to the amount previously expended, gives a total expenditure for this work of $54,929.44. No funds have been expended for maintenance.

By act of Congress approved June 13, 1902, this work was consolidated with Darien Harbor.

No work was done during the fiscal year.

The work which has been done under the existing project secured a channel across the bar 150 feet in width, with a controlling depth of 12 feet at mean low water, but this channel was never marked or used, and a recent examination shows that it has shoaled until it only affords a depth of 7 feet at mean low water. The mean rise and fall of the tide is 7 feet.

Practically no advancement has been made toward the completion of the project and it is quite doubtful if the desired improvement at this bar can be effected by dredging alone, except at great cost. None of the natural or artificial channels across the bar appear to have any stability. Extensive sand shoals lie to the north and south of the entrance to the sound, and the material composing them is easily transported by the littoral currents, which are very strong in this vicinity under the influence of northeast or southeast winds.

The buoyed channel across the bar, which does not follow the line where dredging was done, affords a depth of about 11 feet at mean low water and has a bad turn in it. An examination made recently under unfavorable circumstances indicates that a better and straighter channel can be found affording a depth of 12 feet. If this fact is verified by a more complete examination, the Light-House department will be advised so that, if deemed proper, the buoys may be shifted to mark what appears to be the best water.

No additional work is proposed and no appropriation is recommended.

The commerce interested in this bar consists of lumber received from the Altamaha River and its tributaries, the bulk of which is now shipped from Sapelo Sound and St. Simons Sound, north and south, respectively, of Doboy bar. During the calendar year 1908 2,379,228 feet of lumber, valued at $46,200, crossed the bar.

A list of the Reports of the Chief of Engineers and of executive documents in which projects, maps, and history of the work are printed, may be found on page 278 of the Annual Report of the Chief of Engineers for 1905.

(See Appendix O 4.)

5. *Altamaha, Oconee, and Ocmulgee rivers, Georgia.*—These three improvements were consolidated by the river and harbor act of March 2, 1907.

(*a*) *Altamaha River, Georgia.*—This river is formed by the junction of the Oconee and Ocmulgee rivers. At a point some 25 miles from its mouth the river branches, and the river traffic reaches the ocean by two routes—one by the north branch by way of Darien, and the other by the south branch to where it intercepts the inside waterway, which passage is taken to Brunswick.

Before improvement the Altamaha River was obstructed by rock ledges, sand bars, snags, sunken logs, and overhanging trees. The low-water depths at some points did not exceed 1 foot.

The original project of improvement, submitted in 1875, contemplated a channel 4 feet deep and 80 feet wide from Macon to Darien by the removal of sand bars, rock shoals, snags, overhanging trees, etc., at a cost of $162,000.

Under it and its modifications there was expended up to June 30, 1890, $64,776.59.

The existing project of improvement, adopted by Congress in 1890, provides for the establishment of a channel 3 feet deep at summer low water throughout the river above Darien. This is to be accomplished by removing rock shoals and sand bars, building deflecting dikes, and closing incipient cut-offs, removing snags and sunken logs from the channel and overhanging trees from the banks of the stream, and revetting caving banks. The total estimated cost of the improvement is $129,000, provided funds are regularly and adequately supplied, besides from $3,000 to $5,000 for annual maintenance.

The amount expended on the work under the present project up to June 30, 1909, was $94,059.68 (of which $17,188.64 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $158,836.27.

A total of $111.50 has been received from proceeds of sales of unserviceable property and deposited to the credit of the appropriation.

This expenditure has resulted in the removal of two rock shoals, six sand bars, numerous snags, sunken logs, stumps, and overhanging trees, and the straightening of the river at several points by cut-offs.

The river is navigable from the forks to Darien, a distance of 131 miles, and to where it reaches the inside waterway. The lower section of the river is affected by the tides. The worst shoal is at Coupers bar, which at low water has only about 3 feet of water, but by waiting on tides 5 feet can be had at this place. The controlling depth above the tidal range is about 2½ feet at summer low water. The river is subject to freshets, and in the upper sections the freshet height at times goes 20 feet above the low summer stage. The lower section is bordered by low swamp lands, and the freshets rise from 5 to 10 feet over the banks.

The work done during the year for maintenance consisted of the removal of 209 snags and 10 stumps and the cutting of 406 overhanging trees. Work for improvement consisted of the completion of a training wall at Oglethorpe Bluff and the removal of a false point at Buggs Suck.

The proportion of the approved project accomplished up to June 30, 1909, was about 80 per cent.

It is proposed to apply the available balance and the additional appropriation recommended in removing snags, stumps, and overhanging trees, in removing sand bars and rock shoals, and in repairing old works of improvement.

The additional work proposed is for extension of benefits.

The commerce of the river before the improvement was begun was reported to have amounted to about 100,000 tons annually, valued at about $1,000,000. During the calendar year 1908 it amounted to 13,700 tons, valued at 1,110,000. There was also rafted down the river during the same period 45,855,000 feet b. m. of timber, valued at $614,950.

As nearly as can be determined, the effect of the improvement has been to cause a reduction of from 25 to 40 per cent in freight rates.

A list of Annual Reports of the Chief of Engineers and of executive documents containing projects of improvement, history of the work, maps, etc., may be found on page 279 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1908, balance unexpended		$10,639.32
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		20,639.32
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,204.09	
For maintenance of imbrovement	1,160.00	
		2,364.09
July 1, 1909, balance unexpended		18,275.23
July 1, 1909, outstanding liabilities		782.35
July 1, 1909, balance available		17,492.88
Amount (estimated) required for completion of existing project		94,160.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*b*) *Oconee River, Georgia.*—The head of navigation on this river is Milledgeville, Ga., 147 miles from the mouth, though at present this point can only be reached during high stages of the river.

The river is navigable also for a distance of 17 miles between the Georgia Railroad bridge (54 miles above Milledgeville) and the northern boundary of Greene County. Between Milledgeville and the Georgia Railroad bridge, above, the river is obstructed by obstacles, both natural and artificial, and is incapable of improvement except by an expensive system of locks and dams. At ordinary stages the river is at present only navigable to a point about 25 miles above Dublin, Ga., a distance of 104 miles from its mouth. In its original condition this river was used principally for navigation at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The original project was submitted January 29, 1875, and provided for the removal of snags, overhanging trees, etc., cutting off points, and making cut-offs, at a cost of $10,150.

---

[a] See consolidated money statement on page 348.

Under this project and its modifications there was expended, previous to the commencement of operations under the existing project, the sum of $44,822.18.

The existing project of improvement was adopted by Congress September 19, 1890. It provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Milledgeville to the mouth. This is to be accomplished by removing rock shoals and sand bars, revetting caving banks, and closing incipient cut-offs, removing snags and logs from the channel and overhanging trees from the banks of the stream. The cost of improvement is estimated at $171,000, besides from $3,000 to $5,000 for annual maintenance. The river and harbor act of March 3, 1905, authorized the expenditure of $3,000 of the amount appropriated to be applied to cleaning out the river from the Georgia Railroad bridge to the northern boundary of Greene County, Ga., thus bringing this short section under improvement.

The amount expended under the present project up to June 30, 1909, was $150,421.27 (of which $15,944.47 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $195,243.45.

A total of $648.77 has been received from sales of unserviceable property, which was deposited to the credit of the appropriation.

As a result of this expenditure numerous snags and logs, bowlders, and overhanging trees have been removed, several cut-offs opened and others closed, six training dikes and one spur dam and 800 lineal feet of shore protection built, and five rock shoals and several sand shoals removed below Milledgeville. Between the Georgia Railroad bridge, above Milledgeville, and the northern boundary of Greene County the most troublesome obstructions have been removed from the channel and numerous overhanging trees and logs cut on the banks.

Work done during the fiscal year for maintenance consisted of the removal of 3,278 snags and 3 stumps from the channel and the cutting of 8,010 overhanging trees and girdling of 49 large trees on the banks.

For improvement, 100 cubic yards of rock were removed from the channel at Devils Elbow and 450 cubic yards of earth dredged from the shoal at Steamboat bight; shore protection and a training dike were constructed at Fish Trap shoals and 350 cubic yards of stone quarried for use in proposed dike work.

On June 30, 1909, the controlling depth at ordinary summer low water between the forks and Dublin was about 3 feet, though the channel is very crooked and too narrow for easy navigation. Between Dublin and the Central of Georgia Railway bridge, 25 miles above, the controlling depth was 2.5 feet, and between the latter point and Milledgeville, 2 feet. From the Georgia Railroad bridge, above Milledgeville, to the northern boundary of Greene County, the controlling depth was 2.5 feet. This river occasionally falls below these depths and frequently rises to 20 feet above them.

The proportion of the approved project accomplished up to June 30, 1909, was about 85 per cent.

It is proposed to apply the available balance and additional appropriation recommended toward the removal of snags and stumps from the channel and the cutting of overhanging trees from the forks to Milledgeville; the removal of rock and sand shoals between the forks and the Central of Georgia Railway bridge, 25 miles above Dublin; in making repairs to existing dikes and protecting caving banks; and in closing incipient cut-offs and opening others wherever found advisable.

The additional work proposed is for extension of benefits between the forks and Milledgeville. No additional work above Milledgeville is proposed.

No reliable statistics of the commerce of the river before the improvement was begun are available. During the calendar year 1908 the amount of freight carried on the river between the forks and Milledgeville amounted to 19,000 tons, valued at $247,000. There was also rafted on this portion of the river during 1908, 17,390,000 feet b. m. of timber, valued at $258,000.

As nearly as can be determined the effect of the improvement has been to cause a reduction of from 25 to 40 per cent in freight rates.

A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, map, history of the work, etc., may be found printed on pages 280 and 281 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1908, balance unexpended		$12,645.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		27,645.51
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$5,000.00	
For maintenance of improvement	4,490.19	
		9,490.19
July 1, 1909, balance unexpended		18,155.32
July 1, 1909, outstanding liabilities		1,840.89
July 1, 1909, balance available		16,314.43
Amount (estimated) required for completion of existing project		88,332.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a]

(c) *Ocmulgee River, Georgia.*—In its original condition this river was used for navigation chiefly at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The head of navigation on this river is Macon, a distance of 202 miles from the forks.

The original project was submitted in 1875 and provided for a channel 80 feet wide and 4 feet deep at low water, to be accomplished by the removal of sand bars, rock shoals, snags, overhanging trees, etc., from Macon to Darien, at a cost of $162,000.

The amount expended under this project and its modifications prior to operations under the existing project was $79,390.73.

---

[a] See consolidated money statement on page 348.

The existing project of improvement, adopted by Congress September 19, 1890, provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Macon to the river's mouth. This is to be obtained by removing rock shoals and sand bars, closing incipient cut-offs, revetting caving banks, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement as given in the project of 1890 is estimated at $210,000, provided funds are regularly and adequately provided, besides from $3,000 to $5,000 for annual maintenance.

The amount expended under the present project up to June 30, 1909, was $278,367.49 (of which $27,483.76 was for maintenance), which, added to the amount previously expended, gives a total of $357,758.22.

A total of $802.26, received from sales of unserviceable property, have been received and deposited to the credit of the appropriation.

The work under the present project has resulted in a navigable channel from the forks to Macon. A great deal of work, however, remains to be done between Hawkinsville and Macon.

Work done during the fiscal year for maintenance consisted of the removal of 1,229 snags and 167 stumps from the channel, and the cutting of 944 overhanging trees and 89 logs on the banks; the repairing of training walls near Macon and at Tillman's bar and Hollingsworth Ferry, and the overhauling and repair of plant. Assistance was rendered by the snagboat *Oconee* to the sunken steamer *Small*, which prevented it becoming a wreck and thereby seriously obstructing navigation. For improvement, shore-protection dikes were constructed at Mansfield's place and Newton's place, aggregating 1,346 feet in length; a training wall 511 feet long was constructed at Newton's place; the Atwood jetty, near Macon, was extended 155 feet; Dike No. 3, near Macon, was extended 130 feet; 499 cubic yards of earth and 933 cubic yards of stone removed from Taylors Bluff shoals, near Hawkinsville; surveys were made of Oaky Bluff shoals and at two other localities, with a view to their improvement, and a temporary pile driver, 2 temporary barges, and 4 portable shacks for quartering laborers, constructed.

On June 30, 1909, the controlling depth between the forks and a point 3 miles below Hawkinsville was about 3 feet at ordinary summer low water, and between the latter point and Macon it was about 2½ feet. The river occasionally falls a foot below the ordinary summer stage and frequently rises 20 feet above.

The proportion of the approved project accomplished up to June 30, 1909, was about 95 per cent.

It is proposed to apply the available balance and additional appropriation recommended in the removal of logs, snags, stumps, and overhanging trees, in the removal of rock and sand shoals, maintaining existing training dikes and shore protections, and in the construction of additional dikes and shore protection where necessary, and in the closing of incipient cut-offs and opening others wherever deemed advisable.

The additional work proposed is for extension of benefits.

No reliable statistics of the commerce of the river before improvement was begun are available. In 1908 the freight carried on the river amounted to 18,700 tons, valued at $900,000. Besides this, 26,007,000 feet b. m. of timber was rafted down the river, valued at $288,800.

As nearly as can be determined, the effect of the improvement has been to cause a reduction of from 25 to 40 per cent in freight rates. A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, history of the work, maps, etc., may be found printed on page 282 of the Annual Report of the Chief of Engineers for 1905.

Reference to report on examination of the river ordered by the river and harbor act of March 3, 1905, will be found on page 311 of the Annual Report of the Chief of Engineers for 1906.

The emergency river and harbor act of March 3, 1909, called for an examination and survey of the Ocmulgee River between Macon and Hawkinsville, with a view to its improvement by locks and dams, and, in addition, for a general survey of the Altamaha River system, of which the Ocmulgee forms a part.

July 1, 1908, balance unexpended		$17,479.35
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		32,479.35
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$12,583.63	
For maintenance of improvement	7,351.68	
		19,935.31
July 1, 1909, balance unexpended		12,544.04
July 1, 1909, outstanding liabilities		1,162.99
July 1, 1909, balance available		11,381.05
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

CONSOLIDATED.

July 1, 1908, balance unexpended		$40,764.18
Amount allotted from appropriation by river and harbor act approved March 3, 1909		40,000.00
		80,764.18
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$18,787.72	
For maintenance of improvement	13,001.87	
		31,789.59
July 1, 1909, balance unexpended		48,974.59
July 1, 1909, outstanding liabilities		3,786.23
July 1, 1909, balance available		45,188.36

---

[a] See consolidated money statement on this page.

Amount (estimated) required for completion of existing project	[a]$182,492.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	90,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O 5.)

6. Club and Plantation creeks, Georgia.—A project for dredging a canal 7 feet deep at mean low water, with a bottom width of 50 feet, to connect these two creeks and thus provide an inside route between the Altamaha River and its tributaries and Brunswick Harbor for use of light-draft river boats and timber rafts, will be found printed as House Document No. 159, Fifty-eighth Congress, second session. Besides the dredging of the canal, the project provides for the straightening of Plantation Creek and for dredging in both Club and Plantation creeks where necessary to give a channel 7 feet deep at mean low water. The estimated cost of the work is $40,700. This project was adopted by act of Congress approved March 2, 1907, which appropriated $20,000 toward its completion.

No work has yet been done. Portions of the route cross marsh land owned by private individuals and the city of Brunswick, Ga., and no provision was made in the act for the purchase of a right of way.

During the previous fiscal year a legal title was secured, without costs to the United States, from the city of Brunswick for that portion of the desired right of way owned by the city. During the past fiscal year efforts have been continued to secure the necessary legal title from the owners of the balance of the marshland through which it is desired to dredge the proposed canal, the written permits obtained from the attorneys of these parties the year previous having been held by the Judge-Advocate-General of the army to be insufficient.

At the close of the year the consent of all owners of the desired right-of-way to execute the necessary grants to the United States, free of cost, had been obtained, with the exception of one part owner, with whom negotiations were in progress.

It is proposed to apply the available balance and additional appropriation recommended to the completion of the project, as soon as a valid right of way is obtained.

Reports of examination and survey are printed on page 1669 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1908, balance unexpended	$20,000.00
July 1, 1909, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[b]20,700.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix O 6.)

---

[a] Does not include Ocmulgee River.

[b] If new project for inside water route between Savannah, Ga., and Fernandina, Fla., (H. Doc. No. 1236, 60th Cong., 2d sess.) be adopted, this estimate may be omitted

7. *Brunswick Harbor, Georgia.*—Previous to June 13, 1902, the appropriations for the improvement under the Engineer Department were for the inner harbor only, consisting principally of the removal of a shoal in East River, opposite the lower part of the city. The act of Congress approved June 13, 1902, provided also for the improvement of the bar, which work had theretofore been carried on by direct contract between Congress and a private individual, at a cost of $270,000.

The harbor is navigable from the city of Brunswick to deep water beyond the bar, a distance of 13 miles, and also for 1 mile up Academy Creek, and up Turtle River to the Southern Railway wharves.

The original project of improvement, dated April 29, 1876, provided for the construction of a jetty at the city front and dredging, at a total cost of $69,000.

Under this project and its modifications there was expended, prior to operations under the existing project, the sum of $190,000.

The project in force up to June 13, 1902, was adopted by Congress in 1894. It provided for the maintenance of a navigable channel 15 feet deep at mean low water by keeping the existing works in repair and by dredging. The act of June 3, 1896, provided for the improvement of Academy Creek. The cost of maintaining a channel depth of 15 feet at mean low water was estimated at $15,000 per annum.

There had been expended under this project up to June 30, 1902, $34,817.25, all of which had been for maintenance.

Including $10,000 spent in 1836 for dredging, the total amount expended up to June 30, 1902, on the inner harbor was $234,817.25.

The act of Congress approved June 13, 1902, adopted a project providing for a navigable channel 21 feet deep at mean low water in Brunswick inner harbor, at a cost of $120,000, and for a channel across the outer bar 19.3 feet deep at mean low water (26 feet at mean high water), at a cost of $40,000. It also provided for dredging in Academy Creek at not to exceed $5,000. This project was completed in July, 1905, and expenditures since have been for maintenance.

The river and harbor act of March 3, 1905, authorized the expenditure from the amount therein appropriated of $5,000, or so much thereof as might be necessary, for maintaining in Academy Creek, immediately in front of and adjacent to the wharves thereof, to the Old Altamaha Canal a depth equal to the controlling depth on the shoals at the lower end of the city in East River, provided that no money should be expended inside harbor lines theretofore or thereafter established in said creek. With these funds a channel was dredged with a depth of 18.5 feet at mean low water and a width ranging from 50 to 90 feet.

The amount expended to June 30, 1907, under the project approved June 13, 1902, was $193,062, of which $19,596.82 was for maintenance. This, added to the amounts previously expended, gives a total expenditure for the work up to June 30, 1907, of $697,879.25.

The result of this expenditure has been the accomplishment of a navigable channel throughout the inner harbor 21 feet deep at mean low water and of a channel across the outer bar 19.3 feet deep at mean low water (both 26 feet at mean high water); also of a narrow channel in Academy Creek above mentioned.

A new project was adopted by the act of Congress approved March 2, 1907. This project will be found printed as House Document No.

407, Fifty-ninth Congress, first session. It provides for creating and maintaining throughout the inner harbor (embracing Turtle River from the Southern Railway docks to its junction with Brunswick River, Academy Creek from Aiken's wharf to its junction with East River) and the outer harbor (embracing the outer bar, the navigable channel throughout the entrance to St. Simons Sound, and up Brunswick River to Brunswick Point) channels having a depth of 30 feet at mean high water, with widths varying from 150 feet in Academy Creek to 400 feet across the outer bar, to be accomplished mainly by dredging; but the extension of the existing training wall in East River and the construction of two spur dikes is also authorized. The estimated cost of the work is $496,650, with a yearly cost of maintenance not exceeding $33,250.

Congress in adopting this project appropriated the sum of $146,650 for the work and authorized contracts covering labor and materials necessary for its completion at a cost not to exceed $350,000 additional, all of which has been appropriated.

The amount expended under the present project up to June 30, 1909, was $369,245.25, and resulted in the dredging of a channel in East River, opposite the city of Brunswick, about 8,500 feet in length, 350 feet in width, and 30 feet in depth at mean high water, except for two small areas on the extreme eastern edge of the channel composed of refractory material and which was not required to be removed under the contract in force; the dredging of a channel about 4,700 feet in length, 150 feet in width, and 30 feet in depth at mean high water, in Academy Creek; the dredging of a channel in Turtle River, opposite Buzzards Island, about 3,500 feet in length, 300 feet in width, and 30 feet in depth at mean high water, except at one point on the upper shoal where refractory material was encountered; the removal of 124,420.9 cubic yards of material from the shoal opposite Brunswick Point, and the removal of 1,170,066.5 cubic yards from the channel across the outer bar.

During the fiscal year dredging operations were continued under two contracts and resulted in the removal of 349,160.1 cubic yards of material from the inner harbor, 114,267.5 cubic yards from the shoal opposite Brunswick Point, and 713,211 cubic yards from the channel across the outer bar.

Work was in progress at the close of the fiscal year, and the allotment will suffice to complete the project.

The total amount expended for the improvement of Brunswick Harbor up to June 30, 1909, was $1,067,124.50.

The proportion of the present project accomplished to June 30, 1909, was 85 per cent for the outer bar, 75 per cent for the shoal opposite Brunswick Point, and 90 per cent for the inner harbor.

The controlling depth on the bar, from the basin inside to the bell buoy, a distance of about 3 miles, is 30 feet at mean high water. From the bell buoy to deep sea outside, a distance of about 1 mile, the controlling depth is 28 feet at mean high water, and dredging over this portion is now in progress. At Brunswick Point the controlling depth is 28 feet at mean high water, and dredging over this portion is now in progress; in East River, 30 feet; in Turtle River, upper shoal, 27 feet, lower shoal, north of center range, 29 feet, and on center range and to the south of same, 24.5 feet. The general depth in East River and Turtle River is 30 feet, and these lesser depths are simply a few high points of refractory material for the removal of which a new contract will be made, funds being available for the purpose. In Academy Creek, owing to rapid shoaling since the completion of dredging, there is now at the entrance a narrow channel on one side of the shoal with a depth of 26.5 feet, and upon the other side of the entrance a similar channel with only 22 feet; elsewhere the controlling depth is 30 feet at mean high water.

The mean rise and fall of tide on the bar is 6.6 feet, at Brunswick Point 7 feet, and at the city of Brunswick 7.1 feet.

It is proposed to apply the available balance and additional appropriation recommended in carrying out the approved project and maintaining the improvement. The additional work proposed is for extension of benefits.

Before improvement in 1880 the annual commerce of Brunswick Harbor amounted to about 100,000 tons, valued at $1,700,000. The total commerce of the port for the calendar year 1908 amounted to 1,200,000 tons of freight, valued at $39,892,165. The commerce consists principally of cotton, lumber, cross-ties, naval stores, and general merchandise.

The effect of the improvement has been to cause a reduction of ocean-going freight rates on lumber of 25 per cent and on naval stores of 30 per cent. It has also permitted the regular line coastwise freight steamers to enter and leave the port regardless of the tides, thereby avoiding much loss of time.

A list of the Annual Reports of the Chief of Engineers and of documents containing the various projects, maps, history of the work, etc., may be found printed on page 284 of the Annual Report of the Chief of Engineers for 1905.

Reference to report on survey of Brunswick Harbor, inner and outer, provided for by the river and harbor act of March 3, 1905, will be found on page 312 of Annual Report of the Chief of Engineers for 1906.

Pursuant to a requirement in the river and harbor act of March 2, 1907, an investigation has been made relative to the control and use of wharfage privileges at Brunswick Harbor, and report thereon was duly transmitted to Congress and printed in House Document No. 326, Sixtieth Congress, first session.

July 1, 1908, balance unexpended	$352, 693. 00
Amount appropriated by sundry civil act approved March 4, 1909	47, 000. 00
	399, 693. 00
June 30, 1909, amount expended during fiscal year, for works of improvement	260, 167. 50
July 1, 1909, balance unexpended	139, 525. 50
July 1, 1909, outstanding liabilities	30, 238. 40
July 1, 1909, balance available	109, 287. 10
July 1, 1909, amount covered by uncompleted contracts	43, 044. 85
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	50, 000. 00

(See Appendix O 7.)

8. *Inside water route between Savannah, Ga., and Fernandina, Fla.*—This route consists of a series of bays and tidal sloughs, making a connecting waterway not exposed to rough water except at a few points in stormy weather. The waters forming the route are shown on Coast Survey charts Nos. 156 and 157. It is navigable from Savannah, Ga., to Fernandina, Fla., Brunswick, Ga., and Darien, Ga. The distance from Savannah to Fernandina is 160 miles. Touching at Darien en route increases this by about 20 miles and at Brunswick by about 12 miles.

The project of improvement was adopted in 1892 and provides for the establishment of a channel 7 feet deep at mean low water. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek. The estimated cost of the improvement was $105,000, provided the entire sum be made available at one time.

The total amount expended under this project up to June 30, 1909, was $128,352.47 (of which $63,842.53 was for maintenance), which, added to the amount expended for Jekyl Creek and Romerly Marsh, $71,108.77, makes a total of $199,461.24.

The original estimate for the improvement of this route was completed with the appropriation of $41,000 made by the river and harbor act of March 3, 1905, but the improvement was still unfinished. This resulted from the small appropriations made, extending the work over a very long period, as fully set forth in a report of the district officer printed on page 1208 of the Annual Report of the Chief of Engineers for 1906. The river and harbor act of March 2, 1907, provided for a resurvey of the waterway to determine the best route for further improvement. Report of this resurvey, with estimate of cost, is printed as House Document No. 1236, Sixtieth Congress, second session.

All work done during the fiscal year was for maintenance, and consisted of the dredging of a total of 88,401.6 cubic yards of material, under contract, from shoals at the mouth of St. Augustine Creek, in the Florida Passage, Little Mud River, Frederica River, Jekyl Creek, and Cumberland Dividings, and the raising and extending of the training wall near the head of Jekyl Creek and the raising of the jetty near the mouth of this creek. Work was in progress at the close of the fiscal year.

The completion of the work at Skidaway Narrows (see report herewith) has made this an integral part of the inside route, shortening the distance by 6 miles between Savannah and Fernandina and rendering further work by the way of Parson's cut unnecessary. This makes the proportion of the approved project accomplished up to June 30, 1909, 90 per cent, and Skidaway Narrows should hereafter cease to be regarded as an independent work, but be treated as a portion of the inside route.

On June 30, 1909, the controlling depth between Savannah and Fernandina was 6 feet at mean low water, by way of the new route through Skidaway Narrows, except at the mouth of Mud River, where the controlling depth was 5 feet. By way of the old route through Parson's cut the controlling depth was 2 feet. By waiting on the tides, however, at Parsons cut, Skidaway Narrows, and Mud River a navigation in excess of 7 feet could be carried by either route between Savannah and Fernandina. The mean rise and fall of the tide varies at different localities from 6.5 feet to 8 feet.

It is proposed to apply the available balance and additional appropriation recommended toward restoring and maintaining a 7-foot navigation, at mean low water, throughout the entire route.

The additional work proposed is for extension of benefits.

The value of the commerce passing over this route was estimated in 1890 at between $200,000 and $300,000 per annum. During the calendar year 1908 the commerce amounted to 60,000 tons of freight, valued at $2,300,000. There was also rafted on this route during 1908, 58,985,000 feet b. m. of timber, valued at $787,500. Little, if any, of this commerce passed over the whole extent of the route.

It is impracticable to determine the effect of this improvement upon freight rates, as at present the different portions of the route are used locally, and comparatively few vessels engaged in commerce pass over the entire length of it.

A list of the Annual Reports of the Chief of Engineers and of documents containing the various projects, maps, history of the work, etc., may be found printed in the Annual Report of the Chief of Engineers for 1905, page 285. Report of a resurvey of the route will be found printed as House Document No. 1236, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$24,478.20
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	49,478.20
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	17,830.67
July 1, 1909, balance unexpended	31,647.53
July 1, 1909, outstanding liabilities	3,810.90
July 1, 1909, balance available	27,836.63
July 1, 1909, amount covered by uncompleted contracts	1,945.45
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O 8.)

9. *Skidaway Narrows, Georgia.*—In its original condition the narrows was a narrow, tortuous waterway, formed by two creeks which united at their heads at the meeting place of the tides, connecting Burnside River with Skidaway River. In its natural condition it was navigable only at high water by small sailboats and launches.

The approved project of improvement was adopted by the river and harbor act of March 3, 1905, and will be found printed in the Annual Report of the Chief of Engineers for 1904, pages 1680–1684. This project contemplated the establishment of a navigable channel 6 feet deep at mean low water and 75 feet wide at bottom, connecting Burnside River with Isle of Hope (or Skidaway) River, the route of such channel to be through the marsh and hammock land to the west of the narrows. Subsequent developments made it necessary to abandon this route, principally on account of the difficulty in obtaining the desired right of way through private property. A new route, following practically the course of the narrows, was adopted. The estimated cost of the improvement by the new route is $55,000.

The amount expended up to June 30, 1909, was $55,000.

With the $20,000 appropriated by the river and harbor act of March 3, 1905, a channel with a bottom width of 60 feet and a depth of 5 feet at mean low water was provided over the worst portion of the adopted route, making it available for commerce at high water.

Dredging operations were continued under contract during the fiscal year until November 20, 1908, resulting in the removal of 113,633 cubic yards of material. This work, with that previously reported, accomplished a channel 6 feet deep at mean low water, with a bottom width of 75 feet in the straight portions and 90 to 200 feet at the bends, from deep water in Skidaway River to deep water in Burnside River, and completed the improvement.

The completion of this improvement makes it a portion of the inside route between Savannah and Fernandina, and no further appropriations are recommended for it. The funds necessary for its proper maintenance are included in the estimate submitted for the inside route.

The controlling depth on June 30, 1909, was 6 feet at mean low water.

The mean rise and fall of the tide at this locality is 8 feet.

For commercial statistics, see report on inside water route between Savannah and Fernandina, of which Skidaway Narrows forms a part.

July 1, 1908, balance unexpended	$20,404.81
June 30, 1909, amount expended during fiscal year, for works of improvement	20,404.81

(See Appendix O 9.)

10. Cumberland Sound, Georgia and Florida.—In its original condition the available depth of the entrance varied from 11 to 12.5 feet at mean low water. The point of crossing the bar was subject to very great changes in location, moving in a series of years as much as 1½ miles. The distance from the outer bar to the city of Fernandina, Fla., is about 6½ miles.

The project of improvement submitted in 1879 and revised by a Board of Engineers in 1891 provides for the construction of two low jetties from the shores on opposite sides of the entrance and extending seaward across the bar upon lines so directed that the ends will be parallel to each other and about 3,900 feet apart. These jetties were intended to establish a low-water channel across the bar not less than 19 feet in depth. The cost of the improvement was originally estimated at $2,071,023, and as modified at $1,606,500, for the completion of low jetties, and at $2,079,500 if high jetties were found necessary. There was expended under this project $932,500.

The present project, which was adopted by act of Congress of June 3, 1896, provides for the establishment of a channel across the bar 19 feet deep at mean low water by the construction of two jetties of stone, resting on a foundation of brush mattresses, on the same line as those in the previous project, the scour between the jetties to be aided by dredging, if necessary, the total cost of the improvement, at the time of this project, to be $2,350,000, exclusive of amounts previously appropriated.

The amount expended under this project up to June 30, 1909, was $2,439,947.53 (of which $340,063.13 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $3,372,447.53.

A total of $8.90 received from sale of unserviceable property has been received and deposited to the credit of the appropriation.

By this expenditure two stone jetties have been constructed and a seagoing dredge provided, which together have produced a navigable channel with a minimum width of 400 feet and a controlling depth of 24.5 feet at mean low water, or 5.5 feet more than called for by the project.

All work done during the fiscal year was for maintenance and consisted of the raising and repairing of the South jetty, between stations 8800 and 11350, by the placing of a total of 29,697.57 tons of stone. The jetty between these stations was raised so that its crest was brought up to mean high water. The outer end of the jetty was aproned for about 350 feet with small stone, and this aproning was extended for about 100 feet beyond the outer end of the completed work. A survey of the entrance to Cumberland Sound was made and the results plotted.

The present ship channel, as marked by the ranges, has a controlling depth of 24 feet at mean low water, because of a slight advance of the lower point of Pelican shoal, but by slightly changing the courses run 2 or 3 feet could easily be added to the navigable depth.

The mean rise and fall of tide is 6 feet.

The project for the improvement of Cumberland Sound was reported as completed in the Annual Report of the Chief of Engineers for 1905, page 1287.

It is proposed to apply the available balance and additional appropriation recommended toward raising the low places in the north and south jetties to high-water mark, filling voids and openings in the north jetty, and constructing mounds at the outer ends of both jetties, and for such repairs to the dike on Cumberland Island and such dredging in the jetty channel as may become necessary.

The additional work proposed is for extension of benefits.

As Cumberland Sound merely constitutes the ocean entrance to Fernandina Harbor the commerce is practically the same as that for Fernandina, and since the harbor of Fernandina is now a special work of improvement the commerce is given under that head.

The effect of the improvement has been to cause a reduction in freight rates of from 25 to 40 per cent.

This work has heretofore been mentioned in the law as "Cumberland Sound," but the sole object of the improvement is to afford a deep entrance to the harbor of Fernandina, Fla., and this is what it accomplishes. An appropriation has been made for the improvement of the harbor of Fernandina, and had reference only to the inner portion of the same. It would be better hereafter to unite these two works under one head and refer to them as Fernandina Harbor, Florida.

A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, history of the work, maps, etc., may be found printed on page 288 of the Annual Report of the Chief of Engineers for 1905.

Reference to reports on examination and survey of Fernandina Harbor, ordered by the river and harbor act of March 3, 1905, will be found on page 312 of the Annual Report of the Chief of Engineers for 1906. Map showing conditions June 30, 1908, will be found opposite page 1356, Annual Report of the Chief of Engineers for 1908.

July 1, 1908, balance unexpended	$100,930.14
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	120,930.14
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	85,868.77
July 1, 1909, balance unexpended	35,061.37
July 1, 1909, outstanding liabilities	148.33
July 1, 1909, balance available	34,913.04
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	50,000.00

(See Appendix O 10.)

11. Fernandina Harbor, Florida.—As will be seen from Coast Survey chart No. 453, the lower end of Amelia River forms a deep basin opposite the city of Fernandina, which portion of the river is known as Fernandina Harbor. The lower end of the harbor connects with Cumberland Sound and is 2 miles from the bar. The harbor is about 1,300 feet in width at the entrance and about 2 miles long. It embraces about 160 acres of well-sheltered anchorage ground, with a depth greater than 25 feet at mean low water, but is somewhat obstructed by small shoals. Above this basin there exists a shoal some 4,000 feet in length, with low-water depths over same ranging from 14 to 18 feet. Above this shoal the river separates into two estuaries, which carry deep water for about 2 miles.

A project providing for such extensions of the depth and width of the channel in front of the town of Fernandina as will meet the requirements of commerce will be found printed as House Document No. 388, Fifty-ninth Congress, first session.

The improvement proposed consists in dredging a channel with widths varying from 400 to 600 feet and depths from 20 to 24 feet at mean low water, in front of and to a short distance above (southwest of) the city of Fernandina. The estimated first cost of this work is $115,000, with $15,000 at periods of every two or three years for maintenance after completion.

This project was adopted by act of Congress approved March 2, 1907, which appropriated $115,000 for its completion.

Work under the project was begun September 14, 1907, and completed July 28, 1908. During the fiscal year a total of 46,341 cubic yards of material were removed under contract, completing the project. The engineer building at Old Town, Fernandina, was repaired.

On June 30, 1909, the controlling depths in the channel fronting the city of Fernandina were those contemplated in the adopted project. Very little shoaling has taken place since the project was completed. Soundings indicate some caving in the sides with the depth on the edges of the channel slightly diminished.

The mean rise and fall of the tide is 6 feet.

The amount expended up to June 30, 1909, was $109,398.09.

The project was completed July 28, 1908.

It is proposed to expend the available balance and additional appropriation recommended in maintaining the improvement.

The additional work proposed is for extension of benefits.

Attention is invited to the recommendation in the report on Cumberland Sound that that work and Fernandina Harbor be united under one title and be hereafter reported upon as one work.

Before the improvement of Cumberland Sound (in 1879), which constitutes the ocean entrance to Fernandina Harbor, the annual in and out bound tonnage at Fernandina was about 300,000, and the value of imports and exports estimated at about $2,500,000. The commerce of the port during the calendar year 1908 amounted to 550,000 tons, with a value of $9,274,000. The chief articles of export are lumber, phosphate rock, and naval stores.

The effect of the improvement of Cumberland Sound has been to cause a reduction in freight rates of from 25 to 40 per cent. It can not now be said what further effect the improvement of Fernandina Harbor will have upon these rates.

A map showing conditions June 30, 1908, will be found opposite page 1358, Annual Report of the Chief of Engineers for 1908.

July 1, 1908, balance unexpended	$29,907.02
June 30, 1909, amount expended during fiscal year, for works of improvement	24,305.11
July 1, 1909, balance unexpended	5,601.91
July 1, 1909, outstanding liabilities	50.00
July 1, 1909, balance available	5,551.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O 11.)

RESURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Report dated October 5, 1908, on *resurvey of the inside water route between Savannah, Ga., and Fernandina, Fla.*, with a view to determining the best route of said waterway, required by the river and harbor act of March 2, 1907, was duly submitted by the district officer. It was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and was transmitted to Congress and printed in House Document No. 1236, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $237,700 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE JACKSONVILLE, FLORIDA, DISTRICT.

This district was in the charge of Lieut. Col. Lansing H. Beach, Corps of Engineers, to July 31, 1908, and of Capt. G. R. Spalding, Corps of Engineers, since that date. Division engineer, Col. Dan C. Kingman, Corps of Engineers.

1. St. Johns River, Florida.—This work includes the improvement of the bar at the river mouth and the improvement of the channel from the bar to Jacksonville, a distance of 27.5 miles. Before improvement there was a varying channel across the bar, sometimes 5, sometimes 7 feet deep, and shifting in location through a north and south range of 1 mile. Between the bar and Jacksonville the channel had a least mean low-water depth (at Dames Point) of 11.5 feet.

The range of tide is 5.22 feet at the bar, 4.3 feet at Mayport, 1.8 feet at Dames Point, and 0.8 foot at Jacksonville.

The first project of improvement, adopted in 1879, contemplated a channel 15 feet deep at mean low water from Jacksonville to the ocean. This was to be obtained by dredging and building training walls in the river and by building two stone jetties converging upon the bar, 1,600 feet apart at their outer ends. Under this project the sum of $1,417,000 was expended. As a result the bar channel was fixed and deepened to 13 feet, and the river channel was deepened to 16.5 feet.

The present project, adopted in 1896 and modified in 1903, contemplates a channel from Jacksonville to the ocean 300 feet wide and 24 feet deep, except at Dames Point, where the width was to be 400 feet and the depth 25 feet, this channel to be obtained by dredging and building training walls in the river and by raising and extending the jetties. The estimated cost was $2,109,750, increased in 1908 to $2,176,750, of which $67,000 remains to be appropriated.

The funds appropriated have been expended in building a seagoing suction dredge (*St. Johns*) and a river dredge (*Jacksonville*), in dredging with the plant thus provided and by contract, in building training walls, and in raising and extending the jetties at the entrance. The total expenditure to June 30, 1909, was $2,255,489.80, of which $175,175.99 was for construction of a seagoing dredge and $227,933.39 for work of maintenance. The result has been the completion of the channel contemplated by the project, excepting through the shoals at Trout Creek and at White Shells. At the first place the channel is only about 230 feet wide, the remaining 70 feet being obstructed by rock and soft material.

At White Shells the channel is narrowed about 60 feet by a ledge of coquina rock and has filled in until its width is not more than 150 feet. Shoaling occurred in Browns Creek cut and in Fulton cut, requiring work of maintenance. In these localities the United States dredge *Key West* removed from the channel 153,067 cubic yards of material at a cost of $10,000, restoring projected depths through these cuts to a width varying from 150 to 300 feet. Shoaling at Mile Point cut and at White Shells cut has occurred and contract has been entered into for dredging at these localities under the allotment of $300,000 for the maintenance of this work made from the appropriation of $8,185,750 in the river and harbor act of March 3, 1909.

Under this same allotment contract has been entered into for raising the outer 1,500 feet of the north jetty and filling in critical points in the middle section of that jetty and along the south jetty.

On account of the shoaling at Mile Point and White Shells, the projected depth of 24 feet at mean low tide is not available, it being reduced to 22 feet at Mile Point, but practically a channel having a least available depth of 24 feet does exist, since the increased tidal rise at the shoal localities over that in the upper portion of the river compensates for the decreased depth at low tide.

The increased length and draft of the ships now entering the port of Jacksonville indicates that widening is needed at several bends in the channel, notably at the upper end of Fulton Reach and Browns Creek and at the New Berlin bend. The increased size and speed of the combined passenger and freight steamers plying this river has caused a considerable washing of banks at several places in the river.and indicates the necessity of bank revetment at these points and of increased height of some sections of the training walls.

The channel between the jetties has maintained itself remarkably during the year, indicating that the jetties may be relied upon to do their work with efficiency if properly maintained.

The channel over the outer bar continues to increase in cross section, especially in depth, indicating that a depth over the present projected one could probably be maintained were the channel through Wards Bank trained and concentrated by dredging. It is believed that to properly continue their present efficiency, the north jetty should be restored throughout to its projected height and section and that the south jetty should be also raised to its original height for at least one-half its length.

The district officer estimates that the sum of $200,000 will be required for restoring the jetties to their original cross section where indicated as being desirable; that $85,000 will be required for maintenance by dredging and widening at bends and for necessary bank protection, a total of $285,000, in addition to the sum of $67,000 required to complete the channel at Trout Creek shoal. The project is 97 per cent completed.

The river and harbor act of 1909 provided for a survey of this river with a view toward adopting a more extended project. Should report on this survey lead to the adoption of a new project, the estimate for maintenance would be materially changed.

Were it not for the improvement, freight rates from Florida to northern points would be 50 per cent greater than they are.

The St. Johns River is navigable in fact from the mouth to Lake Washington, a distance of 276 miles, but for deep-draft vessels only as far as Jacksonville, 27.5 miles. The head of steamboat navigation is Lake Poincett, 252 miles from the mouth.

The estimated value of the commerce for 1908 is $60,000,000.

Tonnage by years: 1898, 494,474; 1899, 816,477; 1900, 649,221; 1901, 700,179; 1902, 903,191; 1903, 1,052,076; 1904, 1,000,316; 1905, 1,406,647; 1906, 2,455,101; 1907, 2,485,610; 1908, 1,589,126.

The decrease in tonnage over that given for the years 1906 and 1907 is due, in large part, to the decided falling off in lumber shipments caused by the general commercial depression existing throughout the country. In other respects than that of actual tonnage the commercial activities of the port have largely increased, due to the improved channel. The first shipment of phosphate rock, amounting to 1,600 tons, was made during December, 1908, and charters have already been made for a shipment of a least 200,000 tons of this product during 1909.

During 1908 the following transportation lines were established to this port:

The Gans Line and Burg Line to German ports, and the Logan Line to Liverpool; the Merchants and Miners' Line have made Jacksonville their southern terminus, giving triweekly sailings to Baltimore and Philadelphia; the Jacksonville and Tropical Steamship Line, plying between Jacksonville, Fla., and Habana, Cuba.

To properly estimate the value of the commerce of the port is very difficult, as the value of merchandise shipments, the most valuable portion of the commerce, is known only to the consignees. The more valuable shipments, such as cotton, merchandise, tobacco, etc., have increased in spite of the general business depression, so considerably as to almost if not quite balance the falling off in the lumber trade. It is believed, therefore, that the estimate of $60,000,000 for the value of the commerce is not too large for the last year.

During the first six months of 1909 the foreign commerce of this port amounted to $1,366,453.08, as against $353,670.10 for the same months of last year, and the net tonnage of ships entering and clearing during the months of April and May amounted to over 500,000 tons.

The port statistics for the year are accurate, having been carefully compiled by a thoroughly efficient man employed by the Jacksonville Board of Trade solely for that purpose.

More detailed information may be found in Reports of the Chief of Engineers as listed on page 329 in Report of the Chief of Engineers for 1907.

It is proposed to expend the available balance in prosecuting the work of raising the jetties and maintenance dredging under contract and with hired plant.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, to widening the channel at turns and critical points, to shore protection, and to maintenance of jetties. This work is required to make the improvement available to the class of traffic invited by the depth of channel.

July 1, 1908, balance unexpended	$1,304.50
August 21, 1908, allotted from emergency appropriation, act of March 3, 1905	10,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	300,000.00
Receipts from sales	7.70
	311,312.20
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	11,671.75
July 1, 1909, balance unexpended	299,640.45
July 1, 1909, outstanding liabilities	154.20
July 1, 1909, balance available	299,486.25
Amount (estimated) required for completion of existing project	67,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	250,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P 1.)

2. St. Johns River, Florida, opposite the city of Jacksonville.—The project for improving the St. Johns River from Jacksonville to the ocean provides for a channel 24 feet deep. Between the channel and the pierhead lines at the city of Jacksonville the depths are in many places considerably less than 24 feet. A project for securing a depth of 24 feet at mean low water from the existing channel to the pierhead line on the left bank of the river, between the Florida East Coast Railway bridge and Hogans Creek, was adopted by the river and harbor act of March 2, 1907. The estimated cost (raised in 1908) is $586,500.

Work upon this project began October 1, 1907. The work, as far as available funds permit, is nearly completed, the contractor now being engaged in clearing up after the dipper dredge.

The total expenditure to June 30, 1909, was $309,998.61, of which $3,500 was expended for purchase of a site for a warehouse and wharf for the plant engaged on the St. Johns River work, and $1,105.82 for surveys necessary to relocation of harbor line monuments.

Upon completion of the present contract the entire work will be about 60 per cent completed. The result has been a deepening to about 24 feet over the area between the Florida East Coast Railway bridge and the lower Clyde Line docks, but the clear depth has not yet been secured.

The average rise and fall of tide is 0.8 foot, although under special conditions the river sometimes rises to a height of 3 feet above mean low water.

For commercial statistics and other general information, reference is made to the current report and summary on improvement of St. Johns River, Florida.

The work so far completed has, it is believed, had an advantageous effect on freight rates, as it has permitted deeper draft vessels to reach the wharves, thus obviating the necessity of lightering to midstream.

It is proposed to apply the amount which is estimated as a profitable expenditure in fiscal year ending June 30, 1911, to the completion of the project which is necessary to extend the benefits over the entire frontage contemplated.

July 1, 1908, balance unexpended	$259,149.12
June 30, 1909, amount expended during fiscal year, for works of improvement	197,647.73
July 1, 1909, balance unexpended	61,501.39
July 1, 1909, outstanding liabilities	30,799.51
July 1, 1909, balance available	30,701.88
July 1, 1909, amount covered by uncompleted contracts	13,648.20
Amount (estimated) required for completion of existing project	215,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	215,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix P 2.)

3. *St. Johns River at Orange Mills flats, Florida.*—The object of this work is to obtain a 13-foot channel at mean low water from Jacksonville to Palatka. Before improvement there were four shoals, all near Orange Mills, of less depth than 13 feet. These were Forresters Point shoal, least depth 11.6 feet; Orange Mills flats, 9.8 feet; Racey Point shoal, 10.1 feet; and Tocoi shoal, 11.1 feet.

The mean range of tide is 0.9 foot. The annual variation of water stage is about 3 feet.

The project, adopted in 1893, is to dredge a channel 200 feet wide and 13 feet deep through the shoals named. The estimated cost (increased in 1906) is $185,000.

The total expenditure up to June 30, 1909, was $119,156.50. The result has been the formation of a channel 13 feet deep, 160 feet wide, through Orange Mills flats and Forresters Point shoal and 120 feet wide through Racey Point and Tocoi shoals.

The project is about 64 per cent completed.

The river is navigable to Lake Washington, a distance of 276 miles. The head of steamboat navigation at present is Lake Poinsett, 252 miles from the mouth of the river.

The existence of the St. Johns waterway has probably had an important effect in keeping down freight rates, but the increase of the channel to 13 feet has not, so far as known, caused any changes in rates.

This channel, however, permits light-draft schooners to load at Palatka with cypress lumber from the large mills at that place, and a diminution in depth in the channel, requiring lightering of this material to Jacksonville, would, it is thought, raise the freight rates. Difficulty in navigating this channel is being experienced, due to insufficient width at angles and to the fact that it is not sufficiently marked.

The money expended during the fiscal year was for examination of the channel and for engineering and contingencies.

For more detailed information see Report of the Chief of Engineers for 1898, pages 1344–1348; for 1901, page 1738; for 1904, pages 1690–1691.

For examination and survey ordered by river and harbor act of March 2, 1907, see House Document No. 1111, Sixtieth Congress, second session.

The commerce of the upper St. Johns is chiefly in lumber, shingles, building material, and general merchandise.

Tonnage by years: 1898, 25,866; 1899, 122,074; 1900, 171,500; 1901, 67,500; 1902, 137,950; 1903, 269,610; 1906, 559,838; 1907, 273,070; 1908, 347,764.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to widening existing channels, completing the project. The additional work proposed is for the purpose of extension of benefits.

July 1, 1908, balance unexpended	$1,493.50
June 10, 1909, allotted from emergency appropriation, act of March 3, 1905	3,000.00
	4,493.50
June 30, 1909, amount expended during fiscal year, for works of improvement	650.00
July 1, 1909, balance unexpended	**3,843.50**

Amount (estimated) required for completion of existing project	$65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	65,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix P 3.)

4. Volusia bar, Florida.—The object of this improvement is to secure a channel 5 feet deep through the bar of that name at the head of Lake George, and from that lake to Lake Monroe. Before improvement the channel at this locality was very crooked, with a low-water depth varying between 3.5 and 4.5 feet.

The project, adopted in 1879 and modified in 1882 and 1887, provided for the construction of two converging jetties and for dredging, in order to secure a depth of 5 feet at mean low water, at an estimated cost of $25,000.

The project was completed in 1887 and additional work required is for maintenance. As shoaling is continual, it has been found necessary to dredge from time to time in order to maintain the requisite depth.

The total expenditure up to June 30, 1909, was $45,838, of which $20,838 was for work of maintenance. As a result there is now a channel from Palatka to Sanford having a least depth of 5 feet at mean low stage.

During the year $1,840 was expended from an allotment from the appropriation for emergencies act of March 2, 1907, for the repair of the guiding pile dikes at Volusia bar, the old structures having, on account of their dilapidated condition, become a menace to navigation.

On March 17, 1909, an allotment of $5,000 was made from the appropriation provided by the river and harbor act of March 3, 1909, to be applied to the maintenance of this improvement. No work had been done under this allotment at the end of the fiscal year.

The head of steamboat navigation is Lake Poincett, 252 miles from the mouth.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to maintenance of existing channels.

The usual variation of water level is 2 feet; the extreme variation, 3½ to 5 feet.

The existence of the St. Johns waterway has probably had an important effect in keeping down freight rates, but the increase of the channel depth to 5 feet has not, so far as known, caused any change in freight rates.

The river is navigable in fact to Lake Washington, a distance of 276 miles from its mouth.

For more detailed information see Report of the Chief of Engineers for 1896, pages 1313–1314; for 1897, page 1550; for 1905, page 1296.

The commerce of this portion of the river is chiefly in grain, fertilizers, ship stores, vegetables, and general merchandise. The estimated value of the commerce for 1908 is $3,000,000.

Tonnage by years: 1898, 21,959; 1899, 26,358; 1900, 31,511; 1901, 32,437; 1902, 53,678; 1903, 55,922; 1904, 60,347; 1905, 111,162; 1906, 412,703; 1907, 66,005; 1908, 66,690.

July 1, 1908, balance unexpended[a]	$2.00
September 30, 1908, allotted from emergency appropriation, act of March 2, 1907	1,840.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	6,842.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,840.00
July 1, 1909, balance unexpended	5,002.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	6,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 4.)

5. *Oklawaha River, Florida.*—Before improvement this river was obstructed by snags, accumulation of drift, and overhanging trees.

The project, adopted in 1891, was to clear the river of obstructions, so as to give a navigable channel 4 feet deep at mean low stage from the mouth to Leesburg, a distance of 94 miles, at an estimated cost of $26,000. This was modified by the river and harbor act of March 2, 1907, which provided for removing obstructions and deepening the channel to 6 feet at mean low water from the mouth of the Oklawaha to the head of Silver Springs Run at an estimated additional cost of $15,000. This project is printed in House Document No. 782, Fifty-ninth Congress, first session.

Up to June 30, 1909, the total expenditure under this project was $38,894.41, of which $16,292.12 was for work of maintenance.

As a general result, there is a fairly well-cleared channel 6 feet deep for the first 32 miles of the stream, a practicable channel 4 feet deep at ordinary low stages of the river to Silver Springs Run, 53 miles from the St. Johns River, and a channel 3 feet deep at ordinary stage of water to Leesburg, 94 miles from the mouth. Leesburg is the head of steamboat navigation.

Silver Springs Run, 5½ miles long from the Oklawaha to its head at Silver Springs, affords the best channel of the entire route.

As a result of the expenditure for maintenance, several shoal places have been dredged and many snags and overhanging trees removed.

The original project is believed to be about 55 per cent completed, but owing to the fact that logs and snags are carried by freshets into the stream or moved from the sides into the channel, more work will have to be done that can be estimated from examination or survey.

During freshets the water sometimes rises to a height of 4 feet above its normal stage.

The improvement has had no appreciable effect upon freight rates.

The commerce concerned is small. The boats using the river are chiefly excursion steamers, which run during the winter months. One steamer, however, runs regularly during the entire year and affords the only means of communication for the adjacent country.

---

[a] Refundment of overpayment made in fiscal year ending June 30, 1908.

A considerable revival in interest in this stream is noticeable among the business men at Leesburg, which is situated at the head of navigation, and at Ocala, which is situated 6 miles from the head of Silver Springs Run, and it is quite probable that the completion of the project would have a very decided effect on railroad rates. The river is navigable in fact to Lake Apopka, 130 miles.

Tonnage by years: 1898, 4,481; 1899, 4,291; 1900, 4,847; 1901, 4,530; 1906, 9,298; 1907, 9,129; 1908, 80,279.

On March 17, 1909, the sum of $4,000 was allotted from the appropriation of $8,185,750 provided by the river and harbor act of March 3, 1909, to be applied to the maintenance of this improvement. No work had been done under this allotment at the end of the fiscal year. The amount expended was for examination of the channel and for engineering contingencies.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, to making certain cut-offs, dredging shoals, and removing snags and overhanging trees in the lower river, and in deepening shoal places in the upper river. The additional work proposed is for the purpose of extension of benefits and for maintenance.

For further information see Report of Chief of Engineers for 1896, pages 1314–1316; for 1905, page 1298.

July 1, 1908, balance unexpended	$189.64
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	4,189.64
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	84.05
July 1, 1909, balance unexpended	4,105.59
Amount (estimated) required for completion of existing project	18,208.07
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,710.00

(See Appendix P 5.)

6. Indian River, Florida, between Goat Creek and Jupiter Inlet.—Indian River is a narrow sound between the coast and an outlying fringe of islands. Before improvement the ruling depth was 2.5 feet. The tide is negligible.

The project adopted in 1891 provides for a continuous channel between Goat Creek and Jupiter Inlet 5 feet deep at mean low water and at least 75 feet wide in the straight reaches, with as much greater width as may be required in the turns. The estimated cost is $44,000.

The total expenditure up to June 30, 1909, was $57,878.09, of which $21,191.23 was for maintenance. As a result a channel was obtained 5 feet deep and nowhere less than 50 feet wide between Goat Creek and Pecks Lake.

The project is about 80 per cent completed.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to deepening and widening existing channels, completing the project, and to work of maintenance. The additional work proposed is to make the improvement available.

During the year an examination disclosed that, due to the fact that the spoil banks from dredging were submerged and the channel unmarked, boats were continually grounding on the spoil banks and breaking them down and shoaling the channel. To prevent this, and as an aid in maintenance dredging, substantial channel marks were established. Maintenance dredging is required at several places where not over 4 feet of water exists, which is the maximum depth which can be carried June 30, 1909.

The improvement has had no effect on railroad freight rates, as the stream has no connection with a deep-water port. The river is much used by those engaged in vegetable and fruit culture as a line of communication between packing houses and the nearest railroad station, thus causing a very considerable saving to the producer. The river is an important link in the inside passage along the east coast of Florida and is much used by launches and an auxiliary schooner trading between Lake Worth and Jacksonville. The length of navigable channel under improvement by the Government is 77 miles. The stream, or, more properly, the sound, is navigable in fact, partly through private canals, from St. Augustine to Key West, a distance of 490 miles.

It has been impracticable to secure trustworthy statistics of this commerce, but it is very considerable.

For history, description, and project see Report of Chief of Engineers for 1896, pages 1318–1320; for 1905, page 1299; for 1906, page 1220.

Jupiter Inlet.—This inlet having closed again, an allotment of $2,000 was made June 8, 1909, from the appropriation of $300,000 provided by the emergency river and harbor act of March 3, 1905, to restore the opening. Work under this allotment will begin shortly after the close of the fiscal year.

The total expenditure to June 30, 1909, was $1,500.

July 1, 1908, balance unexpended		$3,642.26
July 27, 1908, and June 8, 1909, allotments ($2,000 each) from emergency appropriation, act of March 3, 1905		4,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		4,000.00
Receipts from sales		5.00
		11,647.26
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	$5,505.73	
Refunded to credit of emergency appropriation	2,000.00	
		7,505.73
July 1, 1909, balance unexpended		4,141.53
July 1, 1909, outstanding liabilities		550.00
July 1, 1909, balance available		3,591.53
Amount (estimated) required for completion of existing project		9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		13,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix P 6.)

7. *Biscayne Bay, Florida.*—Before improvement, Biscayne Bay was navigable for boats drawing less than 3 feet of water. There was a channel, excavated at private expense, 12.5 miles long with a least depth of 10.5 feet, from Miami to the Atlantic Ocean near Cape Florida. The tidal range in the bay is about 1 foot.

The river and harbor act of June 13, 1902, adopted in part a plan proposed by a Board of Engineer officers appointed in accordance with a provision in the river and harbor act of March 3, 1899. This plan contemplated a channel 18 feet deep from the wharves at Miami to the sea by way of a line entering the sea at a point about 4,000 feet north of Norris Cut, and a refuge basin of same depth, 1,200 feet long and 400 feet wide, in some suitable place, this channel to be protected by one or two jetties, as might be found necessary. The estimated cost of the entire improvement was $1,493,743. (See H. Doc. No. 662, 56th Cong., 1st sess.) The act of 1902 appropriated and authorized an expenditure of $300,000 for part of this work, and provided that the Florida East Coast Railway Company should construct, at its own expense, a basin 1,600 feet long and 500 feet wide adjacent to the wharves at Miami and the channel from said basin to the east side of the proposed refuge basin on the east side of the bay; that the amounts appropriated and authorized by Congress should be expended in constructing and protecting the portion of the channel extending to the sea from the terminus of the channel to be constructed by the railway company, of such approximately uniform depth and of such widths as would best serve the interests of navigation and as could be constructed with the funds appropriated and authorized. The act further provided that before any part of the appropriation should be expended the said railway company should enter into a contract with the United States for the performance of its part of the work.

The act of March 2, 1907, modified the project by prescribing a width of 100 feet for the dredged channel, and by providing for a jetty on the southern side of the entrance. The total estimated cost of the work authorized by Congress is $546,000, all of which has been appropriated.

The total expenditure up to June 30, 1909, was $363,720.58, of which $9,759.17 was for emergency work of maintenance by the construction of shore revetment.

As a result there is an available channel 10 feet deep across the bay, the two jetties are completed, and the progress on the necessary rock excavation in the channel between the jetties promises a completion of the present project during the next fiscal year.

During the year the steamers operating between Jacksonville and Habana made Miami a port of call.

The project is about 60 per cent completed. The channel is not open to navigation.

A description of the bay, with report and recommendations of a Board of officers, may be found in Report of the Chief of Engineers for 1900, pages 1986 to 2013. (See also Report for 1905, pp. 1300–1302.)

Tonnage by years: 1899, 18,089; 1902, 8,390; 1903, 13,319; 1904, 16,788; 1905, 40,700; 1906, 56,405; 1907, 106,010; 1908, 151,280.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to maintenance.

July 1, 1908, balance unexpended	$265,580.62
Amount appropriated by sundry civil act approved March 4, 1909	27,000.00
	292,580.62
June 30, 1909, amount expended during fiscal year, for works of improvement	100,541.55
July 1, 1909, balance unexpended	192,039.07
July 1, 1909, outstanding liabilities	12,780.26
July 1, 1909, balance available	179,258.81
July 1, 1909, amount covered by uncompleted contracts	80,198.07
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix P 7.)

8. *Harbor at Key West, Fla., and entrance thereto.*—The entrance referred to is the northwest channel. While Key West Harbor accommodates vessels drawing about 27 feet, the ruling depth over the northwest bar, before improvement, was 10.5 feet at mean low water. The mean tidal range is 2.6 feet.

The project adopted in 1889 contemplated a channel 17 feet deep at mean low water. This was to be secured by building two stone jetties, one to the northeast and one to the west of the channel, converging toward the bar, and by dredging, if necessary. The estimated cost of the east jetty was $500,000.

The act of March 2, 1907, modified the project by authorizing continuance of work on the existing jetties or the building of training walls, in the discretion of the Secretary of War.

The total expenditure up to June 30, 1909, was $667,273.40, of which $2,274.44 was for removing reefs from the main ship channel and $10,000 for maintenance. As a result, the east jetty has been built up to a height of 3 feet above mean low tide for a distance of 5,642 feet, the remaining 5,712 feet being at a level of about 5 feet below mean low tide. The west jetty is about 20 per cent completed and in its present incomplete state is of very little value.

A channel of 17 feet now exists over the outer bar and has been well protected and maintained for two years. The channel across the flats to the southward is in its original state and the ruling depth over this flat, rather than the depth over the outer bar, limits the usefulness of the channel.

It is proposed to apply the available balance to dredging to secure 17 feet of water throughout the channel.

An act of Congress approved May 28, 1908, authorized the expenditure of $5,000 for the purpose of removing certain reefs from the main ship channel from the appropriation for improving this harbor. Of this amount $2,274.44 has been expended, four heads having been removed to a depth of 30 feet by blasting. Further work under this allotment has been postponed until the completion of the sweeping operations which the Coast and Geodetic Survey has now underway for the purpose of locating unknown heads.

It is believed that with funds in hand the channel can be maintained to the present authorized depth.

The existence of the northwest channel has an important effect upon freight rates between Key West and Tampa.

The commerce is chiefly in cattle, fertilizers, tobacco, sponges, and general merchandise.

Tonnage by years: 1898, 72,968; 1899, 130,713; 1900, 30,594; 1901, 18,863; 1902, 14,146; 1903, 134,043; 1904, 174,305; 1905, 132,744; 1907, 189,258; 1908, 218,692.

For further information see listed references on page 335, Report of Chief of Engineers for 1907.

July 1, 1908, balance unexpended	$192,583.83
June 30, 1909, amount expended during fiscal year, for works of improvement	147,303.76
July 1, 1909, balance unexpended	45,280.07
July 1, 1909, outstanding liabilities	577.84
July 1, 1909, balance available	44,702.23

(See Appendix P 8.)

9. Kissimmee River, Florida.—Before improvement the Kissimmee River was tortuous, shallow, and obstructed by snags and overhanging trees. At ordinary stages the least depth was about 2 feet, and in dry seasons navigation was altogether suspended. Canals had been made through some of the worst bends by private enterprise.

The project adopted June 13, 1902, provided for a channel 30 to 60 feet wide and 3 feet deep at ordinary low-water stages in the Kissimmee River (including the connecting canals and lakes) from the town of Kissimmee to Fort Bassinger, and for a channel 25 feet wide and 3 feet deep in Istokpoga Creek. The estimated cost of the improvement was $24,220.90.

The total expenditure up to June 30, 1909, was $27,138.72, of which $6,362.64 was for maintenance. The project is completed.

The result has been a deepening of the channel to a depth of 3 feet from the town of Kissimmee to Fort Bassinger, at ordinary stages of the river, and the clearing of Istokpoga Creek.

The town of Kissimmee is at the head of navigation. The stream is navigable in fact to the Gulf of Mexico, via Lake Okechobee and Caloosahatchee River, a distance of 309 miles. During periods of extreme drought the river is navigable for launches only, but during eight months of the year steamboat navigation is possible.

The commerce of Kissimmee River is in lumber, cattle, fish, naval stores, fruits, vegetables, and general merchandise.

Tonnage by years: 1901, 3,670; 1902, 9,655; 1903, 10,652; 1904, 2,863; 1905, 9,911; 1906, 10,111, 1908 (estimated), 10,000.

The improvement of the stream has lowered freight rates on the supplies handled 75 per cent. There is no rail communication to the country adjacent to this stream, the only other line of supply being by wagon line over poor roads.

Failure to maintain the stream in its present improved state would be no less than a calamity to those living in the lower Kissimmee valley.

During the year $2,703.10 has been expended in clearing away overhanging limbs, in closing subsidiary channels, and in dredging.

On June 30, 1909, there is an available channel having a depth of 24 inches, barely sufficient for the steamboats operating on the stream.

For reference to examination and survey, see page 289, Report of the Chief of Engineers for 1904.

The appropriation recommended is for maintenance of the improvement. The work proposed is to make the improvement available for the ensuing year.

July 1, 1908, balance unexpended	$2,785.38
May 21, 1909, allotted from emergency appropriation, act of March 3, 1905.	600.00
Receipts from sales	26.00
	3,411.38
June 30, 1909, amount expended during fiscal year, for works of improvement	2,703.10
July 1, 1909, balance unexpended	708.28
July 1, 1909, outstanding liabilities	300.00
July 1, 1909, balance available	408.28
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 9.)

10. Orange River, Charlotte Harbor, and Caloosahatchee River, Florida.—These works were consolidated by the act of June 13, 1902.

(*a*) *Orange River.*—Before improvement the least depth was 2.5 feet at mean low water, and the channel was obstructed by snags and overhanging trees.

The project, adopted June 13, 1902, provides for a channel 50 feet wide and 4 feet deep at mean low water from the mouth of the river to the head of navigation. The estimated cost was $2,500.

The total expenditure to June 30, 1909, was $4,000, of which $2,000 was for work of maintenance. No work was done during the past year.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to maintenance.

There is now a navigable channel 50 feet wide and 4 feet deep at mean low water from the mouth of the river to the head of navigation, excepting in the upper portion of the river the full channel width could not be obtained on account of the river width being less than 50 feet.

The mean rise and fall of the tide is 1 foot. The annual variation of water level on account of freshets is about 2 feet. The maximum draft that can be carried at mean low water is 4 feet.

The head of navigation is the iron bridge at Buckingham, about 5¾ miles from the mouth of the river.

The commerce of Orange River is in fruits, vegetables, fertilizers, lumber, and general merchandise. The value of the commerce for the year 1907 was $277,669.34.

Tonnage by years: 1896, 1,250; 1902, 7,155; 1903, 8,555; 1904, 3,099; 1905, 2,074; 1906, 6,258; 1907, 4,002; 1908, 3,936½.

The freight rates are practically the same as before the improvement was made.

For references to examinations and survey, see page 291, Report of Chief of Engineers for 1904, and page 369 of Report of Chief of Engineers for 1908.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$600.00
July 1, 1909, balance unexpended	600.00

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*b*) *Charlotte Harbor and Caloosahatchee River from Puntarasa to Punta Gorda.*—This project was completed in 1903. The amount expended is $106,000. No work was done during the past year.

(*c*) *Caloosahatchee River between Puntarasa and Fort Thompson.*—Before improvement there was a navigable channel with a least depth of 5 feet at mean low water from Puntarasa to Fort Myers, and thence with a least depth of 3.5 feet to Fort Thompson. The upper river was obstructed by snags and overhanging trees.

The project, adopted in 1882 and modified in 1886 and 1888, provided for a channel 100 feet wide and 7 feet deep at mean low water from the mouth to Fort Myers, for a channel 4 feet deep at mean low water across the shoal at Beautiful Island, and for snagging and cutting trees on the upper river.

The project was completed in 1901, at a total cost of $33,600; the results contemplated were obtained.

Since that time $7,554.44 has been expended in work of maintenance. As a result there is a channel 4 feet deep from Fort Myers to Fort Thompson at ordinary stages of water. No work was done during the past year, the amount expended being for contingencies.

On May 12, 1908, the Secretary of War allotted the sum of $3,000 from the emergency appropriation ($300,000) of the river and harbor act of March 2, 1907, for maintenance operations, consisting of dredging shoals, removing snags, and trimming overhanging trees.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to maintenance.

The maximum draft that could be carried on June 30, 1909, was 7 feet from the river entrance to Fort Myers and thence 4 feet to Fort Thompson, 59½ miles above the mouth. The mean rise and fall of tide at the river entrance is 1.6 feet. During freshets the water level in the upper reaches of the river rises considerably.

The Kissimmee River, Lake Okechobee, Caloosahatchee River, and San Carlos Bay form a continuous waterway, navigable in fact from the head of navigation on the Kissimmee River to the Gulf of Mexico, a total distance of 309 miles. From its mouth, in San Carlos Bay, to its source, in Lake Okechobee, the Caloosahatchee River is 84 miles long.

The commerce of Caloosahatchee River is in fruits, vegetables, fertilizers, and general merchandise. The value of the commerce for the year 1908 was $375,000.

Tonnage by years: 1899, 33,101; 1900, 22,737; 1902, 27,895; 1903, 27,576; 1904, 12,255; 1905, 9,577; 1906, 22,265; 1907, 4,467; 1908, 8,064.

No change in the nature of the commerce has resulted from the improvement. The freight rates are practically the same as before the improvement was made.

---

[a] See consolidated money statement on page 373.

References to reports on examinations ordered by the river and harbor acts of March 3, 1905, and March 2, 1907, will be found on page 332 of the Annual Report of the Chief of Engineers for 1906, and on page 369 of report for 1908.

July 1, 1908, balance unexpended		$3,031.24
Amount allotted from appropriation by river and harbor act approved March 3, 1909		400.00
		3,431.24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$31.24	
For maintenance of improvement	54.44	
		85.68
July 1, 1909, balance unexpended		3,345.56
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		[a]
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

CONSOLIDATED.

July 1, 1908, balance unexpended		$3,031.24
Amount allotted from appropriation by river and harbor act approved March 3, 1909		1,000.00
		4,031.24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$31.24	
For maintenance of improvement	54.44	
		85.68
July 1, 1909, balance unexpended		3,945.56
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix P 10.)

11. Sarasota Bay, Florida.—Before improvement there was a navigable channel in Sarasota Bay with least depth of 5 feet at mean low water, except at two shoals, where the depths were 4.3 and 3.5 feet, respectively. Little Sarasota Bay had a channel with a least depth of 1.2 feet at mean low water, except at one shoal which was bare at low water.

The project, adopted in 1889, provides for a channel 100 feet wide and 5 feet deep at mean low water from Tampa Bay to Sarasota at an estimated cost of $17,500.

The sum of $10,000 had been expended under this project when it was modified (in 1896) to include a channel 75 feet wide and 3 feet deep in Little Sarasota Bay from Sarasota to Caseys Pass. The estimated cost of completion of the entire project was $45,000, making a total estimate of $55,000, subsequently increased to $70,000.

The river and harbor act of March 2, 1907, provided for continuing improvement from Tampa Bay to Venice. Venice is about 2 miles southeasterly from Caseys Pass.

---

[a] See consolidated money statement on this page.

The total expenditure to June 30, 1909, was $58,035.25, of which $13,077.18 was for work of maintenance.

The project, as modified by the river and harbor act of March 2, 1907, is about 61 per cent completed.

As a result there is a channel 50 feet wide and 5 feet deep at mean low water from Tampa Bay to Sarasota. From Sarasota to Caseys Pass the channel is 3 feet deep at mean low water, and varying in width from 50 to 75 feet.

The maximum draft that could be carried on June 30, 1909, was 5 feet to Sarasota, and thence to Caseys Pass, 2 feet. Mean rise and fall of tide is 1.5 feet.

The length of the 5-foot channel from Tampa Bay to Sarasota is 20 miles, and the 3-foot channel from Sarasota to Venice is 18 miles.

Venice is the extreme southerly point of the channel and may be given as the head of navigation in fact.

During the winter season, when by far the largest shipments are made, the prevailing winds decrease the mean level of the water in the bay by over a foot. This fact would indicate the desirability of a revision of the project with a view to securing a greater depth with, if necessary, a reduction in width. The river and harbor act of March 3, 1909, provided for a survey of this waterway with a view to securing a revision.

The amount estimated as a profitable expenditure during the fiscal year ending June 30, 1911, includes $10,000 for maintenance, which is necessary to keep this improvement available, and $25,000 which is necessary to complete the project by widening, thus extending present benefits.

The commerce of Sarasota Bay is in naval stores, fruits, vegetables, fertilizers, fish, lumber, and general merchandise. The value of commerce for the calendar year 1908 was $1,300,000.

Tonnage by years: 1899, 9,424; 1902, 4,313; 1903, 4,755; 1904, 25,479; 1905, 8,556; 1906, 12,010; 1907, 13,350; 1908, 54,700.5.

The freight rates have been lowered 25 to 50 per cent, depending on freight classification, since the improvement was undertaken.

For reference to examination and survey, see page 293, Report of Chief of Engineers for 1904.

July 1, 1908, balance unexpended	$7.50
November 2, 1908, allotted from emergency appropriation, act March 2, 1907	3,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	8,007.50
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,000.00
July 1, 1909, balance unexpended	5,007.50
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	35,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P 11.)

12. Manatee River, Florida.—Before improvement there was a least depth of 9 feet at mean low water over the bar at the river mouth; thence to Palmetto the least depth was about 6 feet; thence to Bradentown about 3 feet; thence to Ellenton 7 feet; thence to Rocky Bluff 6 feet; thence to Rye 1½ feet.

The project for the improvement of this river was adopted in 1882 and contemplated a channel 100 feet wide and 13 feet deep from Tampa Bay to Shaw and McNeills Points. This project has been modified as follows: In 1886 to provide for a channel 100 feet wide and 8 feet deep to Manatee, and in 1897 to provide for a cut-off to Terraceia Bay. The river and harbor act of 1907 provided for the completion of the project modified by providing for a channel 100 feet wide and 9 feet deep from Shaw and McNeills Points to Rocky Bluff and thence 4 feet deep and 75 feet wide to Rye.

The total estimated cost of the entire work was $130,520.

The river and harbor act of March 3, 1909, appropriated $10,000 for maintenance of the improvement.

To June 30, 1909, there has been expended $123,826.43, of which $19,540.80 was for maintenance. With this expenditure a channel 12 feet deep and 60 feet wide was dredged across the bar at the mouth in 1883–84. This channel has since been practically obliterated.

A channel 9 feet deep and 100 feet wide has been secured to Rocky Bluff and thence 75 feet wide and 4 feet deep to Rye, and a cut-off channel 100 feet wide and 6 feet deep has been secured to Terraceia Bay.

Operations during the fiscal year consisted in maintenance work in Terraceia Cut-off, in the channel from McNeills Point to Bradentown, and in the section from Rocky Bluff to Rye, and in improvement work between Bradentown, Rocky Bluff, and Rye.

The project is 70 per cent completed.

It is proposed to expend the available balance for completion of the project between Tampa Bay and Shaw and McNeills Points and in maintenance.

No proper estimate for maintenance can be made until a careful survey and investigation has been made to determine the possibility of maintaining a 13-foot channel over the bar at the mouth of the river. This examination will be undertaken in the survey ordered by the river and harbor act of 1909.

A maximum draft of 9 feet can be carried to Rocky Bluff, 6 feet through Terraceia Cut-off, and 4 feet to within 3 miles of Rye.

Mean rise and fall of tides at Manatee River entrance is 1.6 feet. The annual variation of water surface in the upper river on account of freshets is about 3 feet.

The head of navigation is Rye, and length of the navigable channel is 20 miles. The stream is navigable, in fact, a further distance of about 2 miles.

The commerce of the river is in fruits, vegetables, fuller's earth, lumber, naval stores, and general merchandise.

Tonnage by years: 1898, 23,800; 1899, 43,542; 1900, 55,162; 1902, 34,495; 1903, 44,367; 1904, 46,517; 1905, 49,644; 1906, 88,153.

Freight rates have not materially changed as a result of the improvement.

For report of examination and survey made in 1902, see pages 1749–1756, Report of Chief of Engineers for 1904.

It is proposed to apply the available balance to dredging in order to complete the project, and to maintenance.

July 1, 1908, balance unexpended		$62, 264. 45
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10, 000. 00
		72, 264. 45
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$42, 132. 48	
For maintenance of improvement	3, 897. 60	
		46, 030. 08
July 1, 1909, balance unexpended		26, 234. 37
July 1, 1909, outstanding liabilities		2, 997. 80
July 1, 1909, balance available		23, 236. 57

(See Appendix P 12.)

13. Tampa Bay, Florida.—Before improvement the least depth between the Gulf of Mexico and Port Tampa was 13 feet.

The first project, adopted August 11, 1888, contemplated a channel 200 feet wide and 20 feet deep at mean low water from Tampa Bay to Old Tampa Bay. The estimated cost was $63,000. Prior to this work was carried on in connection with improvement of Hillsboro Bay.

The total expenditure under all these projects was $130,000.

The present project was adopted March 3, 1899. It provided for a channel 27 feet deep at mean low water from the Gulf of Mexico to Port Tampa, 500 feet wide across the bar and 300 feet wide in the bay, a channel of full width and 24 feet deep to be first secured, and subsequently deepened. The estimated cost was $750,000.

This project was modified March 3, 1905, by Congress authorizing the Secretary of War to expend the balance remaining to the credit of this improvement in securing a channel 26 feet deep with sufficient width and by providing that no expenditure should be made until the owners of the terminals at Tampa Bay should by valid contract agree that the wharfage charges at such terminal should be submitted for approval to the Secretary of War. A schedule of such charges was approved by the Secretary of War on October 26, 1906.

The amount expended under this project, as revised, to June 30, 1909, was $607,460.81, including contingent expenses and completion of the United States dredge *Key West.*

It is proposed to expend the amount estimated as a profitable expenditure for fiscal year ending June 30, 1911, in dredging for maintenance to keep the improvement available.

Operations during the year consisted in dredging under contract and by government plant in prosecution of the project, which is 80 per cent completed.

The maximum draft that can be carried at mean low water is 24½ feet. Mean rise and fall of tide at Tampa Bay entrance is 1.5 feet and at Port Tampa 2 feet.

The head of navigation for 24½-foot draft is Port Tampa, 35 miles from deep water in the Gulf of Mexico. Tampa Bay is navigable in fact over its entire area.

The commerce is in phosphate, lumber, coal, crude petroleum, tobacco, grain, and general merchandise. The value of the commerce for the year 1908 was $14,821,838.68.

Tonnage by years: 1896, 276,638; 1898, 236,136; 1899, 238,305; 1900, 350,761; 1901, 416,503; 1902, 462,703; 1903, 435,867; 1904, 591,181; 1905,604,131; 1906,838,378; 1907,885,202; 1908,1,314,104.

The freight rates have been lowered 20 per cent on phosphate shipments since the improvement was undertaken.

For report of examination and survey of Tampa Bay, see Report of Chief of Engineers for 1897, page 1596 et seq.

July 1, 1908, balance unexpended	$93, 659. 21
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20, 000, 00
	113, 659. 21
June 30, 1909, amount expended during fiscal year, for works of improvement	91, 095. 56
July 1, 1909, balance unexpended	22, 563. 65
July 1, 1909, outstanding liabilities	1, 700. 00
July 1, 1909, balance available	20, 863. 65
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	18, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 13.)

14. Hillsboro Bay, Florida.—Before improvement the channel from deep water in Hillsboro Bay to the city of Tampa was narrow and tortuous, with least depth of about 4 feet at mean low water.

The first project, adopted in 1880, provided for a channel 9 feet deep at mean low water, 150 feet wide in the bay and 200 feet wide in Hillsboro River. In 1888 the proposed depth was reduced to 8 feet. This project was practically completed in 1893, at a cost of $80,000.

A second project, adopted March 3, 1899, contemplated a channel 12 feet deep at mean low water, 150 feet wide in the bay and 200 feet wide in the river, from the 12-foot contour in the bay to a point 100 feet south of the Lafayette Street Bridge in Hillsboro River. The estimated cost was $300,000. The total expenditure under this project was $275,000. The project was completed, except that the width in a small part of the bay channel was only 110 feet.

A new project adopted March 3, 1905, provided for a channel 20 feet deep at mean low water and 150 feet wide from the lower bay to the mouth of Hillsboro River, with a turning basin at inner end 450 feet wide and 1,050 feet long, at an estimated cost of $448,350. The work was completed on February 29, 1908. The full depth was obtained in the channel excepting in the northwesterly end of the turning basin, where there is a minimum depth of 16.8 feet at mean low water, over a small area where ledge rock is found.

During the fiscal year ended June 30, 1909, the three turns in channel were widened, the turning basin restored to its original depth, and a dolphin constructed near westerly edge of turning basin.

The total expenditure to June 30, 1909, under this project was $448,642.60, of which $37,628.07 was for maintenance. The amount derived from miscellaneous sources was $207.05.

The result of this work has been to make Tampa a terminal point for two railroads and a point of call for freight and passenger steamers plying between Gulf and Atlantic ports.

The maximum draft that can be carried at mean low water through Hillsboro Bay to the head of the turning basin, 360 feet from the mouth of Hillsboro River, is 20 feet. Mean rise and fall of the tide in Hillsboro Bay is 2.2 feet.

The head of navigation for 20-foot draft vessels is Hendry & Knights Garrison dock at Tampa, which is situated on a channel connecting with the turning basin that was dredged by private capital. The head of navigation is 41 miles from deep water in the Gulf of Mexico. Hillsboro Bay is navigable in fact over its entire area.

The commerce of Hillsboro Bay is in cigars, coal, fertilizers, grain, lumber, phosphate, and tobacco. The value of the commerce for the calendar year 1908 was $16,145,504.

Tonnage by years: 1898, 32,070; 1899, 87,740; 1900, 96,029; 1901, 131,208; 1902, 169,844; 1903, 228,252; 1904, 274,399; 1905, 307,460; 1906, 450,056; 1907, 520,629; 1908, 560,281.

During the fiscal year, with an allotment of $1,000 made from the emergency appropriation of March 2, 1907, the usual channel depths in the river to Lafayette Street Bridge were restored.

The freight rates by water were lowered about 10 per cent during the last calendar year, and have been lowered about 35 per cent since the improvement was undertaken.

For references to examinations and surveys see page 295 of Report of the Chief of Engineers for 1904, and House Document No. 1121, Sixtieth Congress, Second session.

It is proposed to expend the available balance and the additional appropriation recommended for maintenance of the project.

July 1, 1908, balance unexpended		$37,548.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
December 15, 1908, allotted from emergency appropriation, act of March 2, 1907		1,000.00
Receipts from sales		16.45
		48,564.95
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$36,628.07	
For maintenance of improvement	1,000.00	
		37,628.07
July 1, 1909, balance unexpended		10,936.88
July 1, 1909, outstanding liabilities		100.00
July 1, 1909, balance available		10,836.88
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix P 14.)

15. *Crystal, Anclote, and Suwanee rivers, Florida.*—These works were consolidated by the act of June 13, 1902, and included Manatee and Withlacoochee rivers. The river and harbor act of March 3, 1905, made separate provision for Manatee River, and the act of March 2, 1907, made separate provision for Withlacoochee River.

(*a*) *Crystal River.*—Before improvement the channel from the Gulf of Mexico to the town of Crystal River was tortuous and shallow, the least depth being 2.7 feet at mean low water. The entrance to the river was obstructed by reefs and sand bars.

The project, adopted June 13, 1902, contemplates a channel 60 feet wide and 6 feet deep at mean low water from the Gulf to the town of Crystal River. The estimated cost was $84,647.46.

The total expenditure to June 30, 1909, was $23,482.40, of which $2,700 was for completion of the dredge *Florida*.

The project was completed on December 6, 1906.

The maximum draft that can be carried at mean low water is 2.7 feet. Mean rise and fall of the tide is 2.3 feet.

The town of Crystal River is at the head of navigation, and the length of the navigable channel is 9 miles.

Maintenance work is needed in this river, and it is proposed to undertake this work with government dredge at an early date with the balance available.

The amount estimated as a profitable expenditure during fiscal year ending June 30, 1911, will be needed for maintenance during that fiscal year in order to keep the improvement available.

The commerce of Crystal River is in lumber, pencil cedar, oysters, fish, and general merchandise. The value of the commerce for the year 1908 was $1,250,000.

Tonnage by years: 1902, 1,785; 1903, 725; 1904, 6,875; 1905, 7,474; 1906, 8,291; 1907, 7,888; 1908, 48,742.

The freight rates have been lowered 10 per cent since the improvement was undertaken.

For references to examinations and surveys, see page 296 of Report of Chief of Engineers for 1904, and page 369 of report for 1908.

July 1, 1908, balance unexpended	$1,730.05
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	4,730.05
June 30, 1909, amount expended during fiscal year, for works of improvement	5.73
July 1, 1909, balance unexpended	4,724.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a] 2,000.00

(*b*) *Anclote River, Florida.*—Before improvement the channel below Tarpon Springs was narrow and tortuous and obstructed by shoals. The least mean low-water depth was 2 feet.

---

[a] See also consolidated money statement on page 381.

The project, adopted March 3, 1899, contemplates a channel 100 feet wide and 6 feet deep at mean low water from Anclote anchorage to Sponge Harbor, and thence 4 feet deep at mean low water to the county bridge at Tarpon Springs. The estimaged cost was $51,500.

The total expenditure to June 30, 1909, was $37,150.50. There is now a channel 6 feet deep and 100 feet wide from the mouth of the river to Anclote, and 4 feet deep and 100 feet wide, thence to the county bridge at Tarpon Springs. The projected width of channel over the outer shoals in Anclote anchorage has not yet been secured and the amount estimated as a profitable expenditure during fiscal year ending June 30, 1911, it is proposed to expend in securing a full width of channel at this point. This is necessary in order to make the full improvement available.

The maximum draft that can be carried at mean low tide to Sponge Harbor is 6 feet, to the county bridge at Tarpon Springs is 4 feet.

The mean rise and fall of tide at Anclote River entrance is 2 feet. The head of navigation is the county bridge at Tarpon Springs. The length of the navigable channel is 5 miles.

The commerce of Anclote River is in sponges, lumber, naval stores, and general merchandise.

Tonnage, by years: 1899, 1,441; 1900, 1,000; 1903, 2,138; 1904, 8,310; 1905, 31,050; 1908, 5,215.

The freight rates have been lowered about 20 per cent.

The project was 72 per cent completed at end of the fiscal year.

For reference to examination and survey, see page 297 of Report of Chief of Engineers for 1904.

It is proposed to expend the available funds in dredging in continuation of the improvement.

July 1, 1908, balance unexpended		$16,345.94
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		21,345.94
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$15,240.21	
For maintenance of improvement	1,256.23	
		16,496.44
July 1, 1909, balance unexpended		4,849.50
July 1, 1909, outstanding liabilities		1,632.45
July 1, 1909, balance available		3,217.05
Amount (estimated) required for completion of existing project		14,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909		[a]14,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(*c*) *Suwanee River, Florida.*—Before improvement the channel in the Suwanee River was narrow and tortuous and obstructed by a bar at the entrance and by bowlders, soft rock shoals, snags, and overhanging trees. The least depth at mean low-water stage was 15 inches.

---

[a] See also consolidated money statement on page 381.

The project, adopted in 1879, provides for a channel 150 feet wide and 5 feet deep from the mouth to Rollands Bluff (75 miles) and thence 60 feet wide and 4 feet deep to Ellaville (60 miles). This is to be secured by dredging, building wing dams, and snagging. The estimated cost is $65,158.

The total expenditure up to June 30, 1909, was $69,451.72, of which $9,203.96 was for maintenance.

The project was 92 per cent completed on June 30, 1909.

As a result, there is now a channel 5.8 feet deep at mean low water and 50 feet wide from the Gulf of Mexico to a distance of one-half mile above the mouth of the river, and thence to Rollands Bluff a channel 5 feet deep at mean low water and 100 feet wide. From Rollands Bluff to Beesons shoal, 2½ miles below Ellaville, there is a channel 4 feet deep at mean low water and varying from 30 to 100 feet in width.

Full channel width has not, however, been secured through the shallow entrance to Suwanee Bay, and it is proposed to expend the available funds for this widening, completing the project, and in maintenance. This work is for the purpose of making the improvement fully available.

The maximum draft that can be carried at the river entrance is about 4 feet.

Mean rise and fall of tide at Suwanee River entrance is 2.4 feet. The annual variation of the water surface in upper river on account of freshets is about 5 feet.

The village of Ellaville is at the head of navigation. Length of the navigable channel is 135 miles.

The commerce of Suwanee River is in lumber, naval stores, and general merchandise. The value of the commerce for the year 1908 was $287,500.

Tonnage, by years: 1898, 106,346; 1899, 76,878; 1904, 7,658; 1907, 25,705; 1908, 11,590.5

The improvement has had no effect on freight rates. Only three steamers now operate on the river occasionally.

July 1, 1908, balance unexpended	$7,074.80
June 30, 1909, amount expended during fiscal year, for works of improvement	789.62
July 1, 1909, balance unexpended	6,285.18

CONSOLIDATED.

July 1, 1908, balance unexpended		$25,150.79
Amount allotted from appropriation by river and harbor act approved March 3, 1909		8,000.00
		33,150.79
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$16,035.56	
For maintenance of improvement	1,256.23	
		17,291.79
July 1, 1909, balance unexpended		15,859.00
July 1, 1909, outstanding liabilities		1,632.45
July 1, 1909, balance available		14,226.55

Amount (estimated) required for completion of existing project..........	$14,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909..	16,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 15.)

16. Withlacoochee River, Florida.—Before improvement the entrance to the Withlacoochee River was crooked and obstructed by reefs. The least depth at mean low water was about 3 feet. Vessels loaded and discharged at an anchorage (called the loading pool) about 9 miles from the entrance. Inside the mouth there was a depth of 7 to 8 feet as far as Inglis, a distance of 9 miles.

The original project, adopted in 1879, provided for a channel having an available depth of 2 feet during about half the year from the mouth of the river to Pembertons Ferry, a distance of 77 miles, and was completed in 1892, at a cost of $24,403.62. A balance of $296.38, together with $5,000 from the consolidated appropriation made by the river and harbor act of 1902, was applied to the construction of the dredge *Florida.*

A project adopted June 13, 1902, provided for straightening the channel from the loading pool to the river mouth and deepening it to 8 feet, and for work of maintenance.

The amount expended to June 30, 1907, was $30,000.41. As a result a channel was obtained with a least depth of 7.8 feet at mean low water and a least width of 60 feet through the most obstructive shoals.

A good deal of dredging has been done by the Port Inglis Terminal Company, under permission granted by the Secretary of War.

The present project, adopted by the river and harbor act of March 2, 1907, provides for a channel 100 feet wide and 10 feet deep at mean low water from Port Inglis to the anchorage in the Gulf of Mexico, at an estimated cost of $215,400 and $5,000 annually for maintenance. The act authorized continuing contracts for completing the work in the sum of $150,000, all of which has been appropriated. Work under this project began April 11, 1908, and at the end of the fiscal year the project was about 20 per cent completed. The amount expended on present project to June 30, 1909, was $47,619.

The head of steamboat navigation is at the county bridge, about 2 miles below Istachatta, or 76 miles above the mouth. The river is navigable, in fact, to Dobes Fish Hole, about 112 miles above the mouth.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, to maintenance in order to keep available the improvement secured under both old and new projects.

The mean rise and fall of tide at Withlacoochee River entrance is 2.8 feet. The annual variation of water surface in the upper river on account of freshets is about 6 feet.

Length of the navigable channel from the loading pool in the Gulf of Mexico to Port Inglis, at mouth of the river, is 9 miles; thence up the river to Inglis, 9 miles; thence to Pembertons Ferry, 68 miles.

The commerce of Withlacoochee River is in phosphate, lumber, coal, iron pyrites, and general merchandise. Port Inglis, at mouth of the river, is a subport of entry. Vessels ply regularly from the anchorage basin off the river entrance to European ports with cargoes of phosphate.

The value of commerce for 1908 was $2,000,000.

Tonnage, by years: 1899, 4,941; 1900, 2,550; 1902, 74,047; 1903, 115,269; 1904, 123,369; 1905, 249,884; 1906, 181,226; 1907, 206,509; 1908, 198,610.

The freight rates have been reduced about 30 per cent since the improvement was begun.

It is proposed to expend the available funds for dredging.

For improvement of the river, see Report of Chief of Engineers for 1904, pages 298–299 and 1710–1711.

For report on preliminary examination and survey authorized by the river and harbor act of March 3, 1905, see House Document No. 483, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$164,210.31
Amount appropriated by sundry civil act approved March 4, 1909	50,000.00
	214,210.31
June 30, 1909, amount expended during fiscal year, for works of improvement	46,429.31
July 1, 1909, balance unexpended	167,781.00
July 1, 1909, outstanding liabilities	11,635.27
July 1, 1909, balance available	156,145.73
July 1, 1909, amount covered by uncompleted contracts	142,256.45
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	12,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 16.)

17. Removing the water hyacinth from Florida waters.—Before improvement many Florida rivers, especially the St. Johns and its tributaries, were badly obstructed by packs of hyacinths. The first project, adopted March 3, 1899, provided for the construction of a boat and booms and for destroying the water hyacinths by crushing, The estimated cost was $36,000, plus an undetermined amount for annual expenditure. Nothing was done under this project, as experience in Louisiana showed that destruction by crushing was impracticable.

In 1902 a new project was adopted, providing for the destruction of the hyacinths by any means whatsoever. The plan adopted under this project was to spray the plants with an arsenical compound. The estimated cost was $50,000 per annum.

Under this project the sum of $84,977.97 was expended. A steamer was purchased and fitted up for spraying, and the main stream of the St. Johns River and a number of tributaries were cleared of hyacinths.

The act of 1905 modified the project by prohibiting any process injurious to cattle. The plan consequently adopted is to close inlets, sloughs, etc., with booms, to break up the packs with a suitable boat, and propel them into the current in order that they may float away.

Work during the year was done on Black Creek, Peters Creek, Highland Park Canal, and Norris Cut, tributaries of the St. Johns River, at Volusia bar, in Kissimmee River, Orange River, and Withlacoochee River, Florida.

The total expenditure up to June 30, 1909, was $113,432.34. In addition to the information obtained as a result of exhaustive experiments, the St. Johns River and many of its tributaries, most of the Kissimmee River, and Orange River were cleared of hyacinths, in so far as they formed an obstruction to navigation.

It is expected that the available balance will be expended in removing the hyacinth from the navigable streams of Florida.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to continuing work of removing water hyacinths. The additional work proposed is for the purpose of extension of benefits.

For further information see Reports of Chief of Engineers listed on page 346 of the Report of the Chief of Engineers for 1907, and see also pages 1333–1334 of the report for 1907.

July 1, 1908, balance unexpended	$18,158.20
June 30, 1909, amount expended during fiscal year, for works of improvement	5,173.74
July 1, 1909, balance unexpended	12,984.46
July 1, 1909, outstanding liabilities	729.94
July 1, 1909, balance available	12,254.52
Amount (estimated) required for completion of existing project	Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 17.)

18. *Removing sunken vessels or craft obstructing or endangering navigation.*—On June 17, 1908, the sum of $700 was allotted for the purpose of removing the wreck of an abandoned phosphate dredge and washer and a cluster of piles in Hillsboro River. A contract was entered into with the Edwards Construction Company, of Tampa, Fla., July 29, 1908, for the removal of these obstructions. Work began August 27 and was completed September 29, 1908. The cost of the work, including incidentals, was $450.

On December 7, 1908, the sum of $1,500 was allotted for the removal of the wreck of the schooner *Addie F. Cole* from the channel leading to Anclote anchorage, Florida. A contract was entered into with C. S. Washington, of Tampa, Fla., January 30, 1909, for the removal of this wreck. Work began February 12 and was completed February 19, 1909. The cost of the work, including incidentals, was $730.84.

On January 22, 1909, the sum of $1,000 was allotted for the removal of the wreck of an old stern dock in Man-of-War Harbor, near Fleming Key, Key West, Fla. The work was done by hired labor, using a leased outfit. The removal of the wreck began May 3 and was completed May 13, 1909. The cost of the work, including incidentals, was $1,000.

On April 21, 1909, the sum of $700 was allotted for the purpose of removing sunken logs, etc., from the Hillsboro River. The necessary outfit was leased and work began May 3 and was completed May 13, 1909. One hundred and fifty-four pieces of obstruction, consisting of logs, timber, etc., were removed. The cost of the work, including incidentals, was $700.

The total expenditures during the year for removing the above-mentioned obstructions was $2,880.84.

(See Appendix, P. 18.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examinations of St. Johns River, Florida, from Jacksonville to Sanford and from Sanford to Lake Harney, and of survey of St. Johns River from Palatka to Sanford and from Sanford to Lake Harney.*—Reports dated June 3, 1907, and October 1, 1908, respectively, are printed in House Document No. 1111, Sixtieth Congress, second session. Two plans of improvement are presented, viz, from Palatka to Sanford at an estimated cost of $109,000, and from Sanford to Lake Harney at an estimated cost of $20,600.

2. *Preliminary examination and survey of Hillsboro Bay, Florida, from the turning basin to the head of the estuary in the direction of Ybor.*—Reports dated July 16, 1907, and April 7, 1908, respectively, are printed in House Document No. 1121, Sixtieth Congress, second session. In view of the wording of the act it has been impracticable to reach a definite conclusion as to the advisability of undertaking this improvement.

3. *Preliminary examination and survey of Estero Bay, Florida.*—Reports dated August 12, 1907, and October 5, 1908, respectively, are printed in House Document No. 1189, Sixtieth Congress, second session. The locality is not considered worthy of improvement at the present time.

4. *Preliminary examination and survey of Clearwater Harbor and Boca Ciega Bay to Tampa Bay, Florida.*—Reports dated August 5, 1907, October 5 and October 27, 1908, respectively, are printed in House Document No. 1190, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $59,000 is presented.

5. *Preliminary examination and survey of St. Lucia (Lucie) Inlet, Florida.*—Reports dated July 19, 1907, and October 1, 1908, respectively, are printed in House Document No. 1312, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $1,400,000 is presented, provided local interests contribute a share of the expense of the necessary work.

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1909.

Reports on preliminary examinations required by the river and harbor act of March 3, 1909, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination of New River, Florida, with a view to securing a depth of 20 feet of water at the cut-off near the mouth, with jetties to protect the same.*—Report dated April 16, 1909, is printed in House Document No. 70, Sixty-first Congress, first session. The locality is not considered worthy of improvement by the General Government in the manner proposed.

2. *Preliminary examination of Indian River, Florida, from Fort Pierce to Sewalls Point.*—Report dated March 31, 1909, is printed in House Document No. 75, Sixty-first Congress, first session. The locality is not considered worthy of improvement by the General Government at the present time.

3. *Preliminary examination of Pine Island Sound, Florida, from Wulfert bulkhead to Blind Pass, thence along the western side of said sound to Captiva bulkhead.*—Report dated April 14, 1909, is printed in House Document No. 77, Sixty-first Congress, first session. The locality is not considered worthy of improvement by the General Government at the present time.

IMPROVEMENT OF RIVERS AND HARBORS IN THE MONTGOMERY, ALABAMA, DISTRICT.

This district was in the charge of Capt. H. B. Ferguson, Corps of Engineers; division engineers, Col. E. H. Ruffner, Corps of Engineers, to August 31, 1908, and Lieut. Col. Lansing H. Beach, Corps of Engineers, since that date.

1. *East Pass and Carrabelle bar and harbor, Florida.*—The town of Carrabelle is situated at the mouth of Carrabelle River, which empties into St. George Sound. The river forms the inner harbor and along the water front its channel varies from 9 to 14 feet in depth, with a minimum width of about 100 feet.

Dog Island anchorage, a protected portion of St. George Sound, showing a 4-fathom depth over a considerable area, forms the outer harbor. Between the 10-foot contours in the inner and outer harbors there is a bar about 6,000 feet wide, which originally had a minimum low-water depth over it of 3½ feet to 4 feet.

Dog Island anchorage is connected with the Gulf of Mexico by East Pass, which originally had limiting low-water depths of about 17 feet on the outer bar and 16.5 feet on the inner bar.

The approved project for Carrabelle bar and harbor, Florida, adopted June 3, 1896, provides for dredging a channel 10 feet deep and 100 feet wide from Dog Island anchorage, St. George Sound, to the city of Carrabelle, at a cost estimated in 1900 at $47,300, in addition to appropriations already expended on the project amounting to $22,399.54. By act of Congress approved June 13, 1902, this project was extended to include the improvement of East Pass by dredging a channel across the bar 20½ feet deep and 150 feet wide, and closing an opening in Dog Island, at an estimated cost of $27,450. This part of the project is completed.

By act of Congress approved March 2, 1907, the project was further extended to include a channel 18 feet deep and 100 feet wide from the 18-foot contour in the outer harbor to a point opposite the beacon situated about 1,000 feet up the river from its mouth, with a suitable turning basin, but the size of the basin was not fixed by Congress, and the estimated cost of the extension of the project has not been determined.

The amount expended up to the close of the fiscal year ending June 30, 1909, was $148,866.15, of which $21,704.08 was expended prior to estimate of 1900, and about $46,110.98 has been applied to maintenance.

The channel at the mouth of the river has been partially dredged from time to time. During 1906 it was completed to a width of 100 feet and a depth of 10 feet from the wharves at Carrabelle to a point 1,400 feet south of the red beacon, and also widened 100 feet at the turn opposite Timber Island, but it shoaled at the inner end. During the past fiscal year a channel 100 feet wide and 10 feet deep has been completed from the wharves at Carrabelle to site of proposed turning basin.

The maximum draft that could be carried through the channel to the inner harbor on June 30, 1909, was 10 feet.

The shoaling of this channel is believed to be due largely to storm action, and it should be protected to the eastward. This will be largely accomplished by the work which the Georgia, Florida and Alabama Railway Company is to undertake.

In 1904 the channel across the outer bar was deepened by dredging from about 17 feet to 20 feet, and across the inner bar from about 16.5 feet to 17.5 feet, this limiting depth being confined to a short distance.

During the past fiscal year a channel across the outer bar was dredged 150 feet in width and 20½ feet in depth. The maximum draft that could be carried through this channel on June 30, 1909, was 20½ feet.

The ordinary range of the tide is about 2 feet.

The commerce of the port of Carrabelle consists principally of timber, naval stores, dressed and kiln-dried lumber, shingles, fish, oysters, and general merchandise, and for the year ending June 30, 1909, is estimated at a valuation of $475,025.

With the work done a substantial reduction in ocean rates is expected, due to increased draft and improved facilities for lighterage, and a further reduction on freight handled by rail should result from the completion of the project for turning basin and 18-foot channel thereto, and the improvements projected by the Georgia, Florida and Alabama Railway Company in connection therewith.

It is proposed to apply the amount estimated as a profitable expenditure during the fiscal year ending June 30, 1911, to completing the 18-foot channel and turning basin, and in maintenance to keep the improvement available.

Reference to reports on examinations and surveys of this harbor will be found on pages 333 and 355 of Report of the Chief of Engineers for 1906.

July 1, 1908, balance unexpended		$48,692.62
Allotment from emergency appropriation, act of March 2, 1907		9,861.35
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		73,553.97
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$43,729.75	
For maintenance of improvement	24,624.94	
		68,354.69
July 1, 1909, balance unexpended		[a] 5,199.28
July, 1, 1909, outstanding liabilities		2,466.51
July 1, 1909, balance available		2,732.77
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		[b] 35,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix Q 1.)

2. *Harbor at Apalachicola Bay, Florida.*—The town of Apalachicola lies at the mouth of the Apalachicola River, and the deep water along the river front forms the inner harbor.

At the mouth of the river, between the inner harbor and the 3-fathom anchorage area in Apalachicola Bay, there is a bar of which the original width between 8-foot contours was 7,000 feet and the minimum depth of water 3.5 feet. Across this bar the lumber exported is lightered either to the 3-fathom anchorage in Apalachicola Bay or through Bulkhead shoals to the anchorage of Carrabelle, 25 miles distant. The 3-fathom anchorage area is entered via West Pass, where originally the depth was about 13 feet. The original depth over Bulkhead shoals was less than 4 feet.

The original project, adopted June 14, 1880, provided for dredging a channel 100 feet wide and 11 feet deep through the bar at the mouth of the river, the width of cut to be increased to 200 feet if the results justified this enlargement.

This project was amended September 19, 1890, to include dredging a channel 9 feet deep and not less than 100 feet wide across the Bulkhead shoals.

Upon this project as amended has been expended $154,000, of which $100,000 has been applied to maintenance in repeated dredging of the cut across the bar at the mouth of the river. The channel through Bulkhead shoals, dredged in 1891–2, remains practically unchanged, with a minimum depth of 8 feet at mean low water.

---

[a] In addition to this balance the further sum of $15,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

[b] The item of $20,000 for dredge construction may be omitted if the improvement of St. Andrews Bay, Fla., is not authorized.

Prior to the adoption of any project of record in this office $18,700 was expended on this improvement—1833–1839—but the object and results of such expenditures are unknown.

By act approved March 3, 1899, a new project was adopted, which provided for a channel 100 feet wide, 18 feet deep at mean low water, through the West Pass along the northern shore of St. George Island and across the bay to the water front of Apalachicola, estimated to cost $350,000, and $20,000 or $30,000 annually for maintenance of completed work.

The amount expended on this project was $130,679.26, of which about $90,000 was for maintenance.

By act of Congress, approved March 2, 1907, a new project was adopted by which the previous project was amended so as to provide for a channel across the bar at the mouth of the Apalachicola River not less than 100 feet wide and 10 feet deep at mean low water and a channel not less than 150 feet wide and 18 feet deep through Link channel and West Pass to the Gulf of Mexico, at an estimated cost of $85,000, and $17,500 annually for maintenance after completion.

During the last fiscal year the channel 10 feet deep and 100 feet wide across the bar at the mouth of the river was completed. For protection of this channel from westward-moving silt, a bulkhead to the east of it was completed during the fiscal year. The length of this bulkhead is 6,900 feet.

About 75 per cent of the project is completed.

The amount expended on this project up to the close of the fiscal year ending June 30, 1909, was $84,871.68, of which $19,359.64 was for maintenance of project of 1899.

The hurricane of September 26–27, 1906, seriously damaged the channel across the outer bar at West Pass by extending the shoal at the western end of Sand Island across the dredged cut, filling it and forcing this part of the channel farther to the west.

The ordinary range of the tide is about 2 feet.

The commerce of this port is in timber, cotton, naval stores, staves, a large quantity of dressed and kiln-dried lumber, shingles, laths, and miscellaneous freight, and for the year ending June 30, 1909, is estimated at a valuation of $712,538.

On June 30, 1909, the maximum draft that could safely be carried through the West Pass entrance to the lower anchorage behind St. George Island was about 14 feet, and the maximum draft that could be carried across the bar at the mouth of the river was about 9 feet.

Reference to reports on examinations and surveys of this harbor will be found on pages 335 and 355 of Report of the Chief of Engineers for 1906.

It is proposed to apply the appropriation asked for to continuing improvement and for maintenance to keep the improvement available.

The portion of the project now completed gives greatly increased facilities to the commerce of this port and a substantial reduction in freight rates on coastwise commerce. The exact amount of this reduction and the reduction on foreign commerce can not yet be stated.

July 1, 1908, balance unexpended		$20,361.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		20,000.00
		40,361.50
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11,052.80	
For maintenance of improvement	9,359.64	
		20,412.44
July 1, 1909, balance unexpended		19,949.06
July 1, 1909, outstanding liabilities		696.17
July 1, 1909, balance available		19,252.89
Amount (estimated) required for completion of existing project		25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		[a]60,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix Q 2.)

3. Apalachicola River, Florida, including the Cut-off and Lower Chipola River, Florida, and the Upper Chipola River from Marianna to its mouth.—(a) Apalachicola River, the Cut-off, and Lower Chipola River.—From the junction of the Chattahoochee and Flint rivers to the Gulf of Mexico (Apalachicola Bay) the Apalachicola River has a length of about 137 miles and a low-water slope of about 3 inches to the mile. The width varies from 150 to 300 yards and the available depth was originally 6 feet at low water, except where obstructed by snags and sunken logs.

The confederate authorities obstructed the channel at a point about 47 miles above the mouth, causing the river to break through by a channel known as Moccasin Slough into the River Styx, the latter a tributary entering the Apalachicola a few miles below the confederate obstructions. Moccasin Slough was very narrow and tortuous and much obstructed by logs, snags, etc., and the former channel has gradually filled up.

About 55 miles above the mouth steamboats may leave the river and, after passing through the Cut-off, Lower Chipola River, and Lee Slough, reenter it about 17 miles farther down, thus making many landings of much greater importance than those upon the corresponding part of the main river, which includes Moccasin Slough, above mentioned.

The original project adopted by the act of June 23, 1874, contemplated securing a channel 100 feet wide and 6 feet deep at low water by the removal of snags and overhanging trees and widening and straightening Moccasin Slough and the Elbows, at an estimated cost of $80,333.

The act of September 19, 1890, adopted an addition to the project, providing for the clearing of a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the Lower Chipola River, at a cost of $7,500.

---

[a] The item of $20,000 for dredge construction may be omitted if the improvement of St. Andrews Bay is not authorized.

The amount expended on work under this project since 1874 to the close of the fiscal year ending June 30, 1909, was $106,485.72. In addition there was expended between 1828 and 1831, $13,000, for which no project is of record. These expenditures have improved Moccasin Slough sufficiently for present purposes and maintained the river reasonably free from snags and other obstructions and enabled steamboats to make use of the Cut-off, Lower Chipola River, and Lee Slough either by day or night. An available depth of 6 feet has been secured in the Apalachicola River and 5 feet in the Cut-off, Lower Chipola River, and Lee Slough. The Cut-off and Lee Slough have been widened also at the narrowest places so that steamboats can pass through readily going downstream and can pass upstream with little difficulty, but the channel in Lee Slough is still very crooked, with some sharp bends that require easing, and the steamboats prefer the main river on the up trip. It is estimated that the project is about 85 per cent completed.

The work was done with the plant belonging to the Chattahoochee and Flint river improvements, and comprised cutting overhanging timber, removing snags and logs, blasting out cypress stumps, and widening the slough and Cut-off by clearing the points of timber and dredging them off, depositing the dredged material in the deep holes or upon the banks.

During the fiscal year work has been confined to the maintenance of the improvement and a small amount of permanent work in the Cut-off and Lee Slough.

Variation of the water level is from 0 to 30 feet at Chattahoochee River bridge.

This river is navigable throughout its entire length of 137 miles.

As the country bordering on the Apalachicola River is largely dependent upon the river for the transportation of its supplies and products, this improvement is essential to the development of this section, but in the absence of any basis of comparison the effect upon freight rates can not be determined.

It is proposed to apply the available balance and the funds recommended to maintenance of Apalachicola River proper by removing annual accumulation of snags, and to continue straightening and widening the Cut-off as above to make the improvement available.

The commerce of the river consists chiefly of cotton, naval stores, general merchandise, saw logs, and timber for export, and is so combined with that of the Chattahoochee, Flint, and Upper Chipola rivers that a separation is impossible. The commerce of all these streams has increased from about $4,000,000 in 1899 to about $12,000,000 in 1909. For detailed statistics see report on Flint River improvement.

For reference to reports of examinations of this river see Report of the Chief of Engineers for 1906, page 337.

(*b*) *Upper Chipola River, Florida, from Marianna to its mouth.*—The river from Marianna to the head of the Dead Lakes has a general low-water depth of 5 feet and width varying from 60 to 200 feet, but is greatly obstructed by rock shoals, snags, and overhanging trees. Three bridges also form obstructions, their headways above low water being 17, 16, and 15 feet, respectively.

At Look and Tremble shoal, about 45 miles above the Dead Lakes, there is a fall of 5 feet in 40 over rock bottom. At Sister Islands, between this shoal and the Dead Lakes, the main channel of the river is very tortuous and obstructed by mud bars over which there is less than 2 feet at low water. The channel through the Dead Lakes, which is considered part of this improvement, has plenty of water, but was obstructed by snags and large cypress stumps and trees.

The approved project, adopted by act of March 3, 1899, provides for clearing a low-water channel 3 feet deep and 60 feet wide from Marianna to the foot of the Dead Lakes, estimated to cost $41,000, exclusive of necessary plant, which would comprise a snagboat, drilling barge, and dump scow.

The amount expended to June 30, 1909, was $20,000. In 1904 $5,000 was applied to the river above Sister Islands. Snags, logs, and overhanging trees were removed, and a channel blasted through the rock reefs from Marianna to Look and Tremble shoal; wing dams were built below some of the shoals, and below Look and Tremble shoal, down as far as Sister Islands, snags, logs, and overhanging timber were removed, as well as available funds permitted. From the lower end of the Dead Lakes for a distance of 35 miles a channel 60 feet wide was cleared of obstructions by removing logs, overhanging trees, cypress stumps, and knees. During the year snagging was done from the Dead Lakes to Look and Tremble shoal. Very little benefit has been derived from the expenditure above Look and Tremble shoal, except to timber industry, but the work done below the shoal and in the Dead Lakes has been of great benefit, as there are many turpentine stills below this shoal, giving a considerable commerce on this portion of the river, and in the Dead Lakes a large commerce in towing logs.

The variation of the water level is 0 to 14 feet.

Two feet is the maximum depth at low water over the shoalest part of the river below the shoal Look and Tremble. The actual head of navigation at ordinary low water is Braxton's landing, 40 miles above the foot of the Dead Lakes. The river is in fair condition to Look and Tremble shoal.

About 50 per cent of the project is completed.

The commerce of this stream consists principally of naval stores, round and square timber, lumber, and other miscellaneous freights, the value of which is included in the combined commerce reported under Flint River improvement.

The section of country below Look and Tremble shoal has no railroads, and depends largely upon this river, the reduction in freight rates being the lessened haul to river as compared to Apalachicola River or railroads to the north and west.

It is proposed to apply the available balance and the funds recommended to dredging and regulation of channel at Sister Islands bar and to removal of snags and overhanging trees in remainder of river. This work is necessary to make the improvement available.

The territory through which the stream flows is heavily timbered with long-leaf yellow pine and cypress, which is now being rafted down this stream in large quantities. The total amount of this traffic is reported as approximately 10,000,000 feet b. m. per annum, and is included in the valuation of timber and lumber exports for Apalachicola Bay and Carrabelle, Fla.

For reference to report of examination of this stream, see Report of the Chief of Engineers for 1906, page 338.

APALACHICOLA RIVER.

July 1, 1908, balance unexpended	$977.50
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	786.74
July 1, 1909, balance unexpended	190.76
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

LOWER CHIPOLA RIVER.

July 1, 1908, balance unexpended		$5,265.92
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,000.00	
For maintenance of improvement	3,182.44	
		5,182.44
July 1, 1909, balance unexpended		83.48
Amount (estimated) required for completion of existing project		3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		([a])

UPPER CHIPOLA RIVER.

July 1, 1908, balance unexpended	$3,589.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,589.00
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

MAINTENANCE.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$13,000.00
June 30, 1909, amount expended during fiscal year for maintenance of improvement	4,009.96
July 1, balance unexpended	8,990.04

---

[a] See consolidated money statement on page 394.

CONSOLIDATED.

July 1, 1908, balance unexpended		$9,832.42
Amount allotted from appropriation by river and harbor act approved March 3, 1909		13,000.00
		22,832.42
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,000.00	
For maintenance of improvement	11,568.14	
		13,568.14
July 1, 1909, balance unexpended		9,264.28
Amount (estimated) required for completion of existing project		33,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix Q 3.)

4. Flint River, Georgia.—Originally this river was navigable at low water from its mouth to Bainbridge, a distance of 36 miles, for boats drawing 3 feet, but the channel was narrow, crooked, and greatly obstructed by logs, snags, and overhanging trees. Above Bainbridge the channel was so obstructed by rock shoals, loose rock, and bowlders that there was no navigation except on a rise of 5 feet, when steamboats could run to Albany, 105 miles above the mouth. Above Albany to Montezuma, 182 miles from the mouth, the channel was so obstructed by sand and rock shoals, bowlders, snags, logs, and overhanging trees that the river was not navigable at a low-water stage.

The original project called for a channel 100 feet wide and 3 feet deep at extreme low water from the mouth of the river to Albany, Ga., at an estimated cost of $184,862.

This project was extended in 1879 to give a channel for light-draft steamers at moderate stages of water from Albany to Montezuma by the removal of logs, snags, and overhanging trees, cutting through rock reefs, and deepening sand bars by contraction works, at an additional cost of $15,000.

The amount expended up to the close of the fiscal year ending June 30, 1909, was $281,711.41, practically all being for permanent work. As a result of the work done, the river is now navigable throughout the year from Albany down to a point about 7 miles below Newton, 40 miles, and from Bainbridge to the mouth, 36 miles, there being a good channel with 3 feet available at low water throughout these sections. The project is about 70 per cent completed.

Between Bainbridge and Newton, for a distance of 29 miles, the river is navigable for light-draft boats only, and the channel is narrow and still much obstructed by bowlders and rock reefs. Considerable work has been done between these points, and operations for the next few years will be confined to this portion of the river. When the improvement of this section has been completed the river will be open to navigation at low water from its mouth to Albany, Ga.

The section between Albany and Montezuma, 77 miles, is still much obstructed, although it has been repeatedly cleared of snags and similar obstructions in accordance with the project.

The water level varies from 0 to 40 feet.

During ordinary low water Albany, Ga., is the head of navigation, but in periods of extreme low water, such as occurred during the fall of 1904, interruptions occur in the section between Bainbridge and Newton.

The commerce consists pricipally of cotton, naval stores, provisions, general merchandise, saw logs, and timber for export. Several very large saw mills are located at Bainbridge, but no record of the amount of lumber manufactured is kept, as shipments are made by rail. A large part of the saw logs used by these mills comes down the river. The commerce of the lower part of this stream is so combined with that of the Chattahoochee and Apalachicola rivers that it is impossible to give a statement in regard to it. The commerce of that part above Bainbridge is estimated to be about 2,800 tons, valued at $100,000.

It is proposed to apply the available balance and the funds recommended toward making the improvement below Albany fully available by widening the channel in many places between Bainbridge and Newton, and removing many obstructions to secure the width of 60 feet and the depth of 3 feet now available in the section above.

This work is largely permanent rock work, and its completion will greatly benefit the section of country between Albany and the mouth of the river. There are many turpentine stills in operation on the river which depend upon the water transportation for their products and supplies.

The effect of the improvement on freight rates, if any, can not be determined.

For reference to reports of examination of this improvement, see Report of the Chief of Engineers for 1906, page 340.

July 1, 1908, balance unexpended	$9,638.18
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	34,638.18
June 30, 1909, amount expended during fiscal year, for works of improvement	10,349.59
July 1, 1909, balance unexpended	24,288.59
July 1, 1909, outstanding liabilities	1,494.24
July 1, 1909, balance available	22,794.35
Amount (estimated) required for completion of existing project	37,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Q 4.)

5. *Chattahoochee River, Georgia and Alabama, below Columbus.*—Columbus, Ga., is 223 miles above the junction of this river with the Flint River and 360 miles above the mouth of the Apalachicola River, formed by the confluence of the Chattahoochee and Flint. Originally boats drawing 22 inches were able to reach Columbus for about nine months each year, but navigation was difficult and dan-

gerous by day and impossible by night, owing to the large accumulation of logs, snags, and overhanging trees, and to sand, rock, and marl shoals obstructing the channel.

The project for the improvement, adopted in 1873, provided for a low-water channel 100 feet wide and 4 feet deep from Columbus, Ga., to Chattahoochee, Fla., at the junction of the Flint, which was to be obtained by the removal of logs, snags, and overhanging trees, cutting through the rock and marl shoals, and scouring out sand bars by works of contraction and shore protection. The estimated cost of this work from Chattahoochee, Fla., to Eufaula, Ala., 139 miles, was $145,247, but no estimate of cost for that part between Eufaula and Columbus was ever made.

The amount expended on this work to the close of the fiscal year ending June 30, 1909, was $723,643.33, largely expended in maintenance, removing the annual influx of obstructions brought in from caving banks. The project is about 80 per cent completed in the upper section above Eufaula and about 10 per cent in the lower section.

No increased depth, except in the upper part of the river, has been gained; but by removing the logs, snags, and overhanging trees, removing the sand, gravel, marl, and rock reefs, and regulating the channel immediately below Columbus, the river has been kept open to navigation. As nearly all the land along the banks of the river and its tributaries has been gradually cleared, each rainy season has brought increasing quantities of sand into the river, filling the original river bed with shifting sand and gravel bars and greatly changing its regimen. Four feet draft can be carried at ordinary low water, but at extreme low water scant 3 feet is the maximum draft that can be counted upon.

Below Eufaula, Ala., the river is now in a fair condition, with an available low-water depth of 3½ feet, but between Eufaula and Columbus there are a number of bars and isolated obstructions which cause trouble, particularly at extreme low water. The most serious of these obstructions was a series of sand bars, formed in the river from the wharves at Columbus down to Mary Freemans bar, 3 miles below, which made it impossible for steamboats to reach Columbus, and the head of navigation during the period of extreme low water was therefore Mary Freemans bar.

During the last few years more liberal appropriations have permitted a more vigorous prosecution of work, and considerable progress has been made on the permanent improvement of the river. In addition to maintaining the river free from snags and obstructions, the channel for a distance of 32 miles below Columbus has been regulated by a system of jetties, and the most serious bars in the upper river have been kept open by dredging where necessary. As a result of this work, Columbus has become the head of navigation, and boats are able to reach there at all times except during unusually low water, such as occurred in the fall of 1904, putting a stop to all navigation.

A large number of other sand bars and shoals between Columbus and Eufaula still need improvement, the regulating works already built require repairs and maintenance, and the annual accumulation of snags and other obstructions must be removed from the river throughout its length.

It is proposed to apply the funds available and the appropriation recommended to this work, the regulating works to be extended down the river from the foot of the present permanent improvement.

The variation of the water level is 0 to 47 feet at Columbus.

The commerce of this stream consists of cotton, cotton seed, fertilizers, grain, naval stores, provisions, hardware, and general merchandise, and is so combined with that of the Flint and Apalachicola rivers that a separation is impossible. It is given under the report of the Flint River as 121,717 tons, valued at $12,000,000.

The effect of the improvement has been to give to Columbus and all other points on the river water rates, or a material reduction over rates to all-rail points, but the exact amount of reduction can not be stated.

For reference to report of examination of this river, see Annual Report of the Chief of Engineers for 1906, page 341.

July 1, 1908, balance unexpended		$81,196.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		115,000.00
		196.196.50
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$45,000.00	
For maintenance of improvement	36,909.05	
		81,909.05
July 1, 1909, balance unexpended		114,287.45
July 1, 1909, outstanding liabilities		13,634.62
July 1, 1909, balance available		100,652.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		[a]115,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix Q 5.)

6. *Choctawhatchee River, Florida and Alabama.*—The Choctawhatchee River is 162 miles long from Newton, Ala., to its mouth, in Choctawhatchee Bay, an arm of the Gulf of Mexico.

Originally the river was impassable during low water for about 10 miles below Newton, due to marl reefs and fish-trap dams, and for the remaining 152 miles to the mouth it was much obstructed by snags, logs, overhanging trees, and sand and gravel bars.

The project for the improvement, as amended in 1890, contemplates the creation of a low-water navigable channel throughout by removing logs, snags, and overhanging trees, by excavating rock and marl shoals, and by contraction works and shore protection, at an estimated cost of $112,832.

The amount expended on this river under the existing project (i. e., since 1874) up to the close of the fiscal year ending June 30, 1909, was $187,455.97, of which the greater part has been expended in maintenance. The expenditures prior to 1874 amounted to $12,876.62

The project has been completed and the additional work required is for maintenance.

---

[a] Item of $40,000 for dredge may be omitted, thus reducing this estimate to $75,000.

The following results have been accomplished:

A channel 40 feet wide and 3 feet deep has been blasted through the marl shoals below Newton to the lower end of these shoals above Pates Landing. The river has been partially cleared of snags and other obstructions from Pates Landing to Geneva, but above Pates Landing to the foot of the shoals it is impassable at lower stages of water. A fairly navigable channel 3½ feet deep at low water was secured by snagging and works of regulation from Geneva to Caryville, but is again much obstructed. The remainder of the lower river has repeatedly been cleared of obstructions, but is at present much obstructed, except the section below the mouth of the Holmes River, which is in fair condition. A channel 75 feet wide and 6 feet deep at mean low water was dredged through the bar at the mouth of the river (Cypress Top).

The actual head of navigation at low water on June 30, 1909, was the mouth of the Holmes River, 33 miles above the mouth of the river. The minimum draft that could be carried to this point was about 3 feet, but the draft is at least 1 foot greater, except at Sandy reach, where trouble has recently developed.

The effect of the improvement on freight rates, if any, can not be stated.

The additional appropriation recommended will be applied to removal of obstructions for maintenance of improvement below Geneva.

There is no commerce on the river above Geneva, with the possible exception of a small movement of logs. Below Geneva there is a large commerce in logs and hewn timber, and five steamers ply between Pensacola and Vernon on the Holmes River.

The commerce on this stream is mainly saw logs, timber, naval stores, and general merchandise, reported at a valuation of $2,211,651 for the calendar year 1908.

For reference to reports on examination of this river, see Annual Report of the Chief of Engineers for 1906, page 343.

July 1, 1908, balance unexpended	$5,869.43
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	10,869.43
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,025.40
July 1, 1909, balance unexpended	5,844.03
July 1, 1909, outstanding liabilities	522.33
July 1, 1909, balance available	5,321.70
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix Q 6.)

7. Holmes River, Florida, from Vernon to its mouth.—Holmes River empties into the Choctawhatchee River about 40 miles above the mouth of the latter. It is a wide and deep stream to the town of Vernon, 25 miles above its mouth, but was originally obstructed by sunken logs, fallen timber, and overhanging trees, and was only available for navigation by small sailing craft and barges, which occasionally made trips up to Vernon.

The present project for the improvement of the stream provides for making a navigable channel by removing logs and snags from the river and overhanging trees from its banks from the mouth up to the town of Vernon.

The total amount expended on this improvement up to the close of the fiscal year ending June 13, 1909, was $16,085.38, of which $13,160.95 was upon Holmes River and $2,160.80 upon Lagrange Bayou.

The project has been completed and additional work required is for maintenance.

The operations during the year consisted in snagging for maintenance of the channel to Vernon, the head of navigation.

The importance of this improvement has greatly increased in the last few years, and five steamers are now engaged in the large and growing trade between Vernon and Pensacola.

The commerce of the stream consists of cotton, turpentine, rosin, molasses, honey, and miscellaneous articles, the value of which in 1908 was $640,000.

For reference to report of examination of this stream, see Report of the Chief of Engineers for 1882, page 1308.

As this river is the only means of transportation in that section, there is no basis for comparison and the effect of the improvement on freight rates can not be stated.

July 1, 1908, balance unexpended	$678.25
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	2,678.25
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	763.63
July 1, 1909, balance unexpended	1,914.62
July 1, 1909, outstanding liabilities	438.24
July 1, 1909, balance available	1,476.38
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Q 7.)

8. *Blackwater River, Florida.*—The original project for this improvement was adopted March 3, 1899, and provided for securing a channel 9 feet deep from Milton, Fla., to Pensacola, Fla., at an estimated cost of $20,000. Under this project $5,000 was expended, and a channel of the required depth secured in the river proper.

The river and harbor act of March 3, 1905, fixed the width of the channel at 100 feet and the estimated cost of completion at $15,000.

With funds appropriated by this act an 8-inch suction dredge and other plant necessary for doing the work were repaired and dredging was commenced in East Bay near the beacon, about 2 miles below Robinsons Point, and a channel about 80 feet wide and not less than

9 feet deep was dredged for a distance of 4,470 feet toward Robinsons Point. This cut has improved the worst part of the channel and increased the available depth over the improvement about 1 foot, and it is estimated that the approved project is about 40 per cent completed. In the execution of this work it has been found that the area to be dredged over is much larger than indicated by the available charts of the improvement, possibly due in part to fill which has taken place since the surveys for the charts were made. To secure a channel 9 feet deep and 100 feet wide over the remaining shoals within the wide limits covered by the improvement is estimated to require $20,000 in addition to funds available. It is to be noted that in the report upon which the present project is based the doubtful character of the original estimate was recognized and the possibility of a considerable increase was clearly foreseen.

The total amount expended on this improvement up to the close of the fiscal year ending June 30, 1909, was $19,733.32, of which about $5,000 was for maintenance. The expenditure during the year was in payment of outstanding liabilities of the preceding year and incidental expenses.

The maximum draft that could be carried over the improvement at mean low water on June 30, 1909, was 8 feet. The usual variation of water surface is 2 feet. The head of navigation is at Milton, about 4 miles above the mouth of the river proper.

The effect of the improvement on freight rates, if any, can not be stated.

It is proposed to apply the additional appropriation recommended to completion of the project and its maintenance thereafter.

The commerce of this stream consists of timber, lumber, naval stores, and general merchandise, having an estimated value of $2,076,000 per annum. The dry dock at Bagdad and marine railway at Milton both do a large business, which would be materially increased by the completion of the project. Lumber brought by rail is stored in the bayou near Milton and taken to Pensacola via this river.

For reference to report of examination of this improvement, see Annual Report of the Chief of Engineers for 1906, page 345.

July 1, 1908, balance unexpended	$270.03
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3.35
July 1, 1909, balance unexpended	266.68
July 1, 1909, outstanding liabilities	31.82
July 1, 1909, balance available	234.86
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Q 8.)

9. *Harbor at Pensacola, Fla.*—The available depth across the inner bar at the entrance to this harbor in 1879, previous to any work of improvement, was 19.5 feet, the width of the channel being contracted by the encroachment of the Middle Ground shoal to the southward.

The harbor entrance and channel way were also obstructed by wrecks, and the western shore line in the vicinity of Fort McRee was cutting away rapidly, almost the whole of the old Fort McRee washing away before the erosion was stopped.

The project of 1877 considered only the removal of the wrecks; that of 1878 called for the removal of these wrecks and for making a survey to determine further recommendations for improvement. The project of 1881 provided for dredging a channel 300 feet wide and 24 feet deep at mean low water for the temporary relief of navigation, and also for protecting the shore line near Fort McRee, with a view to preventing further injurious changes. Dredging under this project was carried on at various times between 1881 and 1893, and at the close of the dredging operations in August, 1893, the available channel was 225 feet wide and 24 feet deep at mean low water. Two groins, one 360 feet and the other 220 feet long, were completed in 1890 and still serve to hold the shore line near Fort McRee.

In 1891 a special Board of Engineers presented a project for opening a new channel across the Caucus shoal, following the direction of the ebb current, by means of two jetties, assisted by dredging, if necessary. In 1895 a second special Board of engineers recommended that no change be made in the project of 1891, but that dredging be tried, using one of the hydraulic dredges belonging to the United States to open up a channel 26 feet deep at mean low water and as wide as practicable on the line of deepest water across the Caucus shoal and approximately on the line of the axis of the jettied channel proposed by the Board of Engineers in 1891. In December, 1895, this channel was opened by the U. S. dredge *Gedney* to a width of 120 feet and depth of 24 feet at mean low water. It has a length of about 10,000 feet across Caucus shoal and is now known as the Caucus channel.

In 1896 the same Board that recommended the first amendment to the project of 1891 submitted a second amendment providing for the expenditure of all funds available in continuing the work of dredging across the Caucus shoal and for building a dredge and opening the channel across the Caucus shoal 30 feet deep at mean low water to a width of at least 300 feet, with such side slopes as the material would assume, if sufficient funds were made available by Congress. Until a channel should be opened by dredging across the Caucus shoal, as above proposed the Board recommended that the construction of the jetties for its maintenance be not considered.

The river and harbor act of March 3, 1899, extended this project to "securing a channel depth of 30 feet at mean low water, from the Gulf of Mexico to the dock line at the east end of the city of Pensacola."

The amount expended on these projects to June 30, 1905, was $725,956.94. The work done comprises the removal of the wrecks obstructing the channel, dredging a large amount of material from the inner bar, opening and redredging a 30-foot channel across the Caucus shoal, and the protection of the shore line from erosion by the construction of two groins near old Fort McRee.

The river and harbor act approved June 13, 1902, appropriated $220,000, of which $150,000 might be used in constructing a seagoing suction dredge. This dredge, the *Caucus*, was built and turned over to the district in August, 1905. The same act modified the project, which now provides for dredging a channel 30 feet deep and 500 feet wide from the Gulf of Mexico to the dock line at the east end of the city of Pensacola. There is no approved estimate of the cost of this project. Under this amended project there has been expended for dredge construction $172,221.27 and for the improvement $259,995.39, of which about $175,000 has been applied to maintenance.

The project is about 33 per cent completed.

The dredge *Caucus* commenced dredging September 18, 1905, and at the close of the present fiscal year had removed a total of 2,039,138 cubic yards of material. This work has restored the channel to its original dimensions and widened it, and removed the shoaling due to the storm of September, 1906, so that on June 30, 1909, the minimum width of channel having a depth not less than 30 feet at mean low water was approximately 300 feet.

From July 1, 1908, to October 11, 1908, the *Caucus* continued dredging. On October 11 she was docked at the Pensacola Navy-Yard for annual repairs. Owing to lack of funds she was sent to Carrabelle, Fla., after repairs were completed, returning to Pensacola June 1, 1909, since which time she has been at work with one pump, on account of pump shaft being broken.

The maximum draft that could be carried over the improvement at mean low water on June 30, 1909, was 30 feet, and the ordinary range of the tide is about 1.1 feet.

The commerce of this port is very large. For the fiscal year ending June 30, 1903, the foreign exports were reported as $13,741,540, no record of the coastwise exports being available; in 1904, as $15,893,456; in 1905, exports as $15,295,067, and imports as $985,840; in 1906, exports as $18,432,931, and imports as $386,377; in 1907, exports as $20,229,414, and imports as $618,363; in 1908, exports as $20,322,649, and imports as $675,503; in 1909, exports as $16,306,056, and imports as $1,188,925.

The completion of the project will give greatly increased facilities to the large commerce of Pensacola, but will not materially affect freight rates.

It is proposed to apply the appropriation recommended in dredging operations toward completion of the project and maintenance of the project depth.

July 1, 1908, balance unexpended		$38,333.11
Amount allotted from appropriation by river and harbor act approved March 3, 1909		110,000.00
		148,333.11
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$10,000.00	
For maintenance of improvement	25,971.24	
		35,971.24
July 1, 1909, balance unexpended		112,361.87
July 1, 1909, outstanding liabilities		3,121.54
July 1, 1909, balance available		110,240.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		90,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix Q 9.)

10. *Escambia and Conecuh rivers, Florida and Alabama.*—These two names apply to one and the same stream, which flows through a heavily timbered country in southern Alabama and western Florida into Escambia Bay, an arm of Pensacola Bay. The change of name occurs at the boundary line between the two States. The timber from this district is brought down the river and forms a large part of all that is exported from Pensacola. Originally the river was much obstructed by snags, marl reefs, and sand bars, and a bar at its mouth, where the rafts are made ready to be towed to Pensacola, prevented the entrance of tugs and seriously interfered with navigation.

The first appropriation for the improvement of this river was made in 1833, and prior to the adoption of the present project $5,000 was expended in removing obstructions. A subsequent appropriation of $5,500, made in 1836, was returned to the surplus fund in 1838. No further appropriations were made until 1880.

(*a*) *General improvement.*—The present project, as originally adopted June 14, 1880, provided for the improvement of the river from its mouth to Indian Creek, Alabama, an estimated distance of 293 miles, by the removal of snags, logs, and overhanging trees, by excavating rock shoals, by works of contraction and shore protection, and by dredging a channel 150 feet wide and 5½ feet deep at mean low water through the bar at the mouth, all at an estimated cost of $87,430, but the recent adoption of a separate project for the Conecuh River has, in effect, fixed the upper limit of the improvement as the mouth of Patsaliga Creek. The project has been completed and additional work required is for maintenance.

The amount expended on this project to June 30, 1909, was $153,101.94, largely for maintenance. These expenditures have kept the river fairly free from snags, opened the channel across the bar at the mouth from time to time, and greatly facilitated the rafting and towing of timber; but, due to lack of funds in recent years, the river, which in 1900 was practically free from obstructions from its mouth to near the mouth of Patsaliga Creek, again became so much obstructed as to seriously interfere with the rafting at low-water stages. During the year the stream was cleared of obstructions for a distance of 162 miles.

It is proposed to apply the appropriation recommended in snagging and dredging toward maintenance of the improvement.

Reference to reports of examination of this improvement will be found on pages 348 and 349 of the Report of the Chief of Engineers for 1906.

(*b*) *Conecuh River.*—By act of Congress, approved March 2, 1907, a project was adopted for completing the improvement of the Conecuh River from the mouth of Patsaliga Creek to the State line between Florida and Alabama by removal of bowlders, snags, and rock shoals, in accordance with report submitted in House Document No. 159, Fifty-ninth Congress, first session, at an estimated cost of $31,000.

For work under this project a plant consisting of a quarter boat and two working barges has been constructed. The field work commenced July 22, 1907. During the fiscal year ending June 30, 1909, 92 miles of river was worked over, 34 miles being new work. Funds now available will be sufficient to complete the project for this section of river. Subsequent maintenance can be more conveniently and logically provided for under the general project.

The actual head of navigation during ordinary stages of the river is at the mouth of Patsaliga Creek, about 195 miles above the mouth of the Escambia River.

Commerce consists of timber floated in rafts, the value of which in 1908 is estimated at $3,863,000.

Work now completed influences the transportation of timber on 170 miles of river, which has been greatly facilitated, admitting of rafting on stages of water some 3 feet less than formerly. The freight per thousand by rail from River Falls, a point 3 miles below Patsaliga Creek, to water is $1.50; by river, it is 75 cents.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$7,913.86
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	12,913.86
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,656.37
July 1, 1909, balance unexpended	6,257.49
July 1, 1909, outstanding liabilities	1,735.17
July 1, 1909, balance available	4,522.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

CONECUH RIVER.

July 1, 1908, balance unexpended	$21,518.33
Received from refundment of overpayment	.10
	21,518.43
June 30, 1909, amount expended during fiscal year, for works of improvement	10,877.76
July 1, 1909, balance unexpended	10,640.67
July 1, 1909, outstanding liabilities	863.89
July 1, 1909, balance available	9,776.78

(See Appendix Q 10.)

11. Alabama River, Alabama.—This river is formed by the junction of the Coosa and the Tallapoosa, 11 miles below Wetumpka, on the Coosa River, and from this junction to its junction with the Tombigbee to form the Mobile it constitutes a 312-mile link in a waterway 815 miles long, from the Oostenaula and Coosawattee rivers, Georgia, to the Gulf of Mexico.

The river was originally so obstructed by logs, snags, and overhanging trees, and shoals, many with depths of but 2.5 feet, that during the low-water season navigation was practicable by day only. Long detentions were frequent at many of the shoals below Selma, and when the water was unusually low traffic was suspended between Selma and Montgomery for three or four months in the year.

The original project, adopted in 1878, for the improvement of this stream provided for securing a low-water channel 4 feet deep and 200 feet wide by removing snags, logs, and overhanging trees; by constructing works of regulation, and by dredging, all at an estimated cost of $229,741. On this project $185,000 was expended, principally in snagging operations and the construction of works of contraction. These expenditures greatly improved the condition of the channel, freeing it from obstructions, and secured a low-water depth of 4½ to 5 feet.

In 1891 the original project was amended to provide for a low-water channel 6 feet deep, which was to be secured in the same general way as contemplated in the original project, and the estimated cost was placed at $386,251, provided that at least $100,000 should be appropriated annually and $10,000 a year thereafter for maintenance. The project is about 30 per cent completed.

Under this project there has been expended to June 30, 1909, $488,009.09, largely for maintenance, but until recently appropriations have been very small and the channel has been deteriorating, work on the river being confined to the operations of the snag boat. During the last three years the plant has been thoroughly overhauled and materially increased.

The river and harbor act of March 3, 1905, contemplated securing a continuous channel not less than 4 feet deep in the Alabama River by open-channel work, and as the benefits to be derived from the improvement are very great, funds should be provided for the vigorous prosecution of work.

Operations during the year consisted in snagging, dredging, and construction of contraction works at various points.

During the year the maximum draft that could be carried to Montgomery at low water was about 3 feet, but as the boats operating on this river draw from 4 to 6 feet, the boats came only to Selma till high water.

It is proposed to apply the appropriation recommended in snagging, dredging, and construction of contraction works in furtherance of the project and in maintenance of the improvement.

The actual head of navigation at ordinary low water is Wetumpka, on the Coosa River, and the variation of the water level is from 0 to 59 feet at Montgomery.

The commerce of this stream is important, consisting principally of cotton, cotton seed, fertilizers, grain, lumber, shingles, naval stores, staves, and a large quantity of miscellaneous freight of all descriptions, the value of which for the year 1908 is estimated at $9,000,000. This, however, is but a part of the freight movement that is affected by the improvement, for the actual shipments by water have been relatively small, and, with a river improved for continuous navigation, it is estimated that at least 100,000 tons of the present all-rail freight movement would either go by river or at river rates, and the resulting saving would be very large. In addition, improved facilities would render possible an actual reduction in rates on freight now carried by river.

For reference to reports of examinations made of this river, see Annual Report of the Chief of Engineers for 1906, pages 349 and 350.

July 1, 1908, balance unexpended		$170,389.22
Amount allotted from appropriation by river and harbor act approved March 3, 1909		110,000.00
		280,389.22
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$60,000.00	
For maintenance of improvement	64,348.31	
		124,348.31
July 1, 1909, balance unexpended		156,040.91
July 1, 1909, outstanding liabilities		14,975.00
July 1, 1909, balance available		141,065.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		90,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix Q 11.)

12. Coosa River, Georgia and Alabama.—The Coosa is formed at Rome, Ga., by the junction of the Oostenaula and Etowah rivers, which have their sources in northern Georgia. The Oostenaula is formed by the junction of the Coosawattee and Connesauga rivers, 56 miles northwest of Rome. The Oostenaula above Rome, Ga., and its tributary, the Coosawattee, are navigable for light-draft boats during nine months of the year for a distance of about 105 miles, but the Etowah and the Connesauga are not navigable.

The Coosa River has always been navigable for light-draft boats from Rome, Ga., to Greenport, Ala., an estimated distance of 162 miles, and this part of the river is of such a character as to make its improvement by works of contraction and channel excavation entirely practicable, except at Horseleg shoals, near Rome, Ga., where a lock of low lift will be ultimately required.

From Greenport, Ala., to Wetumpka, Ala., a distance of 142 miles, locks and dams are required in conjunction with works of contraction and channel excavation to provide for navigation.

From Wetumpka to the junction of the Tallapoosa River the river is navigable at all seasons.

The ordinary variations of the water surface are, at Rome, Ga., 0 to 30 feet; at Greenport, Ala., 0 to 15 feet; at Wetumpka, Ala., 0 to 50 feet.

The improvement of these rivers is provided for under the two following projects (for reference to report upon proposed modifications of projects for improving the Coosa River, see Annual Report of the Chief of Engineers for 1905, p. 326):

(*a*) *Coosa River between Rome, Ga., and East Tennessee, Virginia and Georgia Railroad bridge.*—The original project for the improvement of the Coosa River contemplated the opening of a continuous water route of transportation from the Mississippi River to the Altantic Ocean by way of the Ohio, Tennessee, Coosa, Etowah, Ocmulgee, and Altamaha rivers, with canals from the Tennessee to the Coosa and from the Etowah to the Ocmulgee. This was designated as the "southern route."

Various examinations and estimates for the improvement of parts of this section of river have been made from time to time up to the adoption of the existing project, September 19, 1890. This project, as modified by act of Congress of July 13, 1892, formed a part of a plan submitted in 1875 for a proposed waterway from the Mississippi to the Atlantic via the Tennessee River, and provides for a crib and timber lock 200 by 32 feet and a 3-foot lift, with excavation for a 4-foot channel between Rome, Ga., and Wills Creek in Alabama, at a total estimated cost of $180,000; for three locks between Greenport and Dam 4 (Whisenant and Ten Island shoals), 210 feet long, 40 feet wide, and an extreme low-water depth of 4 feet on miter sills, together with a 3-foot channel between Locks 1 and 3, at a total estimated cost, including accessory dams and dikes, of $155,616.23; for five locks and dams from and including Dam 4 to the East Tennessee, Virginia and Georgia Railroad bridge, the locks to have an available length of 280 feet, width of 52 feet, and an extreme low-water depth of 6 feet over the miter sills, together with a connecting channel 100 feet wide and 4 feet deep at extreme low water, at a total estimated cost of $1,160,491, or at a total cost for the entire improvement of $1,496,107.23. About 21 per cent of the project has been completed.

To June 30, 1909, there has been expended on this section of the Coosa $1,101,016.88, of which $577,316.88 has been expended upon the existing project and $523,700 prior to its adoption. The work accomplished is as follows, of which expenditures about 10 per cent has been for maintenance:

Locks 1, 2, and 3, Coosa River, commenced prior to 1890, have been completed. They are situated, respectively, 0.68 mile, 3.86 miles, and 5.24 miles below Greenport, Ala., and have available lengths of 175 feet and widths of 40 feet.

Lock and Dam 4 (25.89 miles below Greenport), commenced since the adoption of larger dimensions above mentioned, has, together with its appurtenances, been under construction, with desultory appropriations, since 1886, but still incomplete.

Channel improvement has been extended as far down as Dam 4, and navigation is now possible to this point, except at extreme low water, when interruptions occur a short distance above Dam 4.

During the past fiscal year work was confined to the improvement and maintenance of the channel between Rome, Ga., and Dam 4, Alabama, and to care of the large amount of plant on hand. Provision should be made for further improvement and maintenance of this channel.

On June 30, 1909, the maximum draft that could be carried at ordinary low water between Rome, Ga, and Dam 4 was 3 feet, except, at Horseleg shoal, 1½ miles below Rome, over which but 2 feet can be carried until a lock is constructed at this point. Survey and estimate for this lock have been submitted.

It is proposed to apply the additional appropriation recommended toward further improvement and maintenance of the channel between Rome, Ga., and Dam 4, Alabama.

The improvement has resulted in a reduction in railroad rates between points on the river and either Rome or Gadson of not less than 50 per cent, water rates controlling all shipments to and from the country contiguous to the river.

The commerce of this portion of the Coosa consists principally in cotton, cotton seed, fertilizers, timber, lumber, staves, grain, and miscellaneous articles, amounting, for the year 1908, to 24,189 tons, valued at $2,500,000. Lumber and logs valued at $73,000 were also reported as moved.

(*b*) *Coosa River between Wetumpka and East Tennessee, Virginia and Georgia Railroad bridge.*—On account of the numerous rapids this part of the river has never been navigable.

The original project for the improvement of this section of the river adopted September 19, 1890, as the result of a survey made in 1889 and modified by Congress July 13, 1892, contemplates slackwater navigation and provides for the construction of 23 locks and dams of varying lifts, of an available length of 280 feet and width of 52 feet, with 6 feet over the miter sills, no lift of lock to exceed 15 feet. In addition, the channel is to be cleared of various rock reefs and points so as to give a least depth of 4 feet, all at an estimated cost of $5,106,422. About 4 per cent of the project has been completed.

There has been expended on this project to June 30, 1909, $401,372.22, of which about 2½ per cent has been for maintenance, which has resulted in the construction of the lowest lock of the series, known as "No. 31," excepting the dam and grates, the excavation of the channel between this lock and the one next above, and the preparation of data and plans for additional locks and dams, but these data are still incomplete. As yet no benefit has been derived from this improvement, and its value is entirely dependent on the completion of the entire system.

Provision should be made for the care of the property belonging to the improvement.

CONSOLIDATED.

July 1, 1908, balance unexpended		$30,530.68
Amount allotted from appropriation by river and harbor act approved March 3, 1909		40,000.00
		70,530.68
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$21,906.79	
For maintenance of improvement	5,000.00	
		26,906.79
July 1, 1909, balance unexpended		43,623.89
July 1, 1909, outstanding liabilities		3,204.91
July 1, 1909, balance available		40,418.98
Amount (estimated) required for completion of existing project		6,059,913.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		60,000.00

(See Appendix Q 12.)

13. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.—Locks 1, 2, and 3 were open to navigation on June 30, 1890, and have been operated continuously since, except during such periods as it was necessary to close them for repairs and for a period of ten days in February, 1895, when the canal between Locks 2 and 3 was frozen over.

The amount expended to the end of the fiscal year ending June 30, 1909, was $185,015.43.

The expenses of operating and care of Locks 1, 2, and 3, and Dam 4 during the fiscal year have been paid from the permanent indefinite appropriation provided for by section 4 of the act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act approved March 3, 1909.

These expenses amounted to $5,218.84, exclusive of liabilities outstanding on June 30, 1909, of $167.09.

(See Appendix Q 13.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination and survey of Alabama and Coosa rivers, Alabama, between Montgomery and Wetumpka.*—Reports dated November 15, 1907, and October 8, 1908, respectively, are printed in House Document No. 1089, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $36,000 is presented.

2. *Preliminary examination and survey of Coosa River at Horseleg shoals, near Rome, Ga., with a view to the construction of a lock and dam.*—Reports dated September 4, 1907, and October 8, 1908, respectively, are printed in House Document No. 1115, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $241,039 is presented.

3. *Preliminary examination and survey of Coosa River, Georgia and Alabama, with a view to locating and constructing Dam No. 5, in the State of Alabama.*—Reports dated September 4, 1907, and October 8, 1908, respectively, are printed in House Document No. 1421, Sixtieth Congress, second session. A plan of improvement at an estimated cost of $134,000 is presented.

4. *Preliminary examination and survey of St. Andrews Bay, Florida.*—Reports dated November 15, 1907, October 10, 1908, November 5, 1908, and March 1, 1909, respectively, are printed in House Document No. 12, Sixty-first Congress, first session. A plan for improvement at an estimated cost of $203,560 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE MOBILE, ALABAMA, DISTRICT.

This district was in the charge of Maj. Henry Jervey, Corps of Engineers, having under his immediate orders First Lieut. W. G. Caples, Corps of Engineers, to August 5, 1908. Division engineers, Col. E. H. Ruffner, Corps of Engineers, to August 31, 1908, and Lieut. Col. Lansing H. Beach, Corps of Engineers, since that date.

1. *Mobile Harbor, Alabama.*—This channel originally had minimum depths of 5½ feet through Choctaw Pass and 8 feet through Dog River

bar, at mean low water, the available draft to Mobile, via Spanish River, being limited to the latter depth.

The improvement of the channel of Mobile Harbor has been progressive. Between 1826, the date of the first appropriation for this work, and 1857 a channel 10 feet deep was dredged through the shoals in Mobile Bay up to the city of Mobile. Between 1870 and 1876 this depth was increased to 13 feet, the channel being dredged to a width of 300 feet through Choctaw Pass and 200 feet through Dog River bar.

In 1880 a project for a channel 17 feet deep and 200 feet wide was adopted, and appropriations between 1878 and 1886 were applied to the formation of a channel of these dimensions.

In the river and harbor act of August 11, 1888, a project for securing a channel 23 feet deep was adopted this project being modified by the river and harbor act of September 19, 1890, so as to provide for the formation of a channel 23 feet deep and with a top width of 280 feet from the Gulf of Mexico to the mouth of Chickasaw Creek, above the city of Mobile. Work upon this channel was completed in 1896, subsequent appropriations, up to and including that made by the sundry civil act of July 1, 1898, having been applied to its maintenance.

The total amount expended on these projects was $3,648,630.60, of which about $115,000 is estimated to have been applied to maintenance.

The existing project for the improvement of Mobile Harbor provides for the formation of a channel 23 feet deep and 100 feet wide at bottom, with appropriate slopes, from the entrance of the bay to the mouth of Chickasaw Creek, at an estimated cost of $1,640,000, and the removal of sunken obstructions from Mobile Harbor at such times as the latter work may be authorized. This project was adopted by the river and harbor act approved March 3, 1899, and was modified by the acts of June 13, 1902, and March 3, 1905.

The work of forming a 23-foot channel in Mobile River and Bay under this project was commenced in 1899, and under two continuing contracts, during the progress of which 12,402,956 cubic yards of material, scow measurement, was removed up to November 11, 1903, an uninterrupted channel of the projected depth and from 55 to 150 feet width was formed within the limits of the project.

After the storm of September 27, 1906, the channel shoaled in places to as little as 17 feet. Under a contract the worst of the shoaling was remedied at a cost of approximately $100,000, 1,109,410 cubic yards of material being removed.

The work of removing sunken trees, logs, timbers, and other dangerous obstructions from the channel of Mobile Harbor has been prosecuted when necessary with funds allotted for that purpose.

The existing project was modified by the river and harbor act of March 2, 1907, so as to include the completion of the work proposed by the existing project at an estimated cost of $560,000, and the prosecution of operations to provide increased depth progressively as may be possible with appropriations of $100,000 annually for a period of five years.

The construction of a dredge was authorized. All of the $560,000 has been appropriated. Of this amount $10,000 was applied to the removal of sunken obstructions from Mobile Harbor, $545,000 was allotted to work of dredging and nearly all so applied, and $5,000 to the preparation of plans for a dredge. It was proposed to apply $200,000 of this money to the construction of a dredge, but the administrative act approved May 28, 1908, contained the following provision:

> SEC. 7. That the whole or any part of the amount heretofore authorized to be appropriated for the construction of a dredge for Mobile Harbor, Alabama, with the exception of five thousand dollars for the preparation of plans for said dredge, may be used for dredging said harbor, and the Secretary of War, in his discretion, may enter into a contract or contracts for the performance of the work.

The funds are therefore being applied to dredging, except the $5,000 for dredge plans.

The modification of project is printed in House Document No. 647, Fifty-ninth Congress, first session.

To June 30, 1909, there was expended on the existing project as modified $1,777,528.49, of which $551,166.03 was applied to work of maintenance.

The work of dredging under contract dated July 10, 1907, approaching completion at the end of the last fiscal year, was completed in July, 1908, leaving depths of from 23½ to 25 feet throughout the channel, except where shoaling had occurred in the lower end.

Plans for a dredge were completed.

At the beginning of the fiscal year there was a small amount of dredging to be done to complete the contract then in force, and the work was finished by the removal of 23,533.4 cubic yards of material over a distance of 3,100 feet between Chickasaw Creek and Beacon 22, in July, 1908.

Under date of February 1, 1909, another contract was made for dredging in Mobile Harbor in the application of the funds mentioned in the administrative act above quoted from, which funds were appropriated by the act of March 4, 1909, and up to June 30, 1909, 74,321 feet of channel was worked over under this contract, removing about 2,145,000 cubic yards of material, the width of cut being from about 85 to about 125 feet, the purpose of the work being to widen the channel sufficiently to afford 23 feet depth for a width of 100 feet at bottom, and to form appropriate side slopes. The location of this work was from Beacon 10–A to Beacon 8, from Beacon 6–A to 1,635 feet south, and from 150 feet south of Beacon 6 to Beacon 2. There is about 8,000 feet of channel yet to be dredged.

At the beginning of the fiscal year there was a small balance available for removing obstructions from the harbor, and with this a little work was done in July, 1908. Work was resumed in April of this year, with an allotment of $10,000 from the river and harbor act of March 3, 1909. The total work during the fiscal year consisted in removing 355 logs, snags, and stumps from that part of the channel needing this work most. Operations are still in progress.

From the river and harbor act of March 3, 1909, there was allotted $100,000 for dredging work in Mobile Harbor.

The funds available will be applied to work of dredging in Mobile Harbor and to the removal of sunken obstructions in maintenance of the improvement. With future appropriations work will be continued under the approved project.

On June 30, 1909, the maximum low-water draft that could be carried over the shoalest part of the dredged channel was between 23 and 24 feet at mean low water. The average range of tide is 1½ feet.

Mobile River is navigable for vessels of about 14 feet draft up as far as its head, 45 miles above Mobile.

Detailed information with reference to the work accomplished under the existing project is contained in the Annual Reports of the Chief of Engineers for 1901, page 1810, and 1904, page 1803. A reference to the report of the survey upon which the project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 324.

The combined commerce, foreign and domestic, using Mobile Harbor during 1908 aggregated 1,838,101 tons, valued at $58,507,433. Cotton, lumber, timber, breadstuffs, and hog products are the principal articles of export, and bananas and sisal grass the most important of imports.

The effect of the project has been to give Mobile an average reduction of about 20 per cent on rail freight rates from Atlantic seaport cities and to afford direct water freight rates from Mobile to foreign ports.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended		$160, 238. 54
June 30, 1909, receipts from sales		408. 00
Amount appropriated by sundry civil act approved March 4, 1909		200, 000. 00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		100, 000. 00
		460, 646. 54
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$100, 000. 00	
For maintenance of improvement	175, 424. 50	
		[a] 275, 424. 50
July 1, 1909, balance unexpended		185, 222. 04
July 1, 1909, outstanding liabilities		74, 545. 00
July 1, 1909, balance available		110, 677. 04
July 1, 1909, amount covered by uncompleted contracts		4, 000. 00
Amount (estimated) required for completion of existing project		77, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		([b])

REMOVING OBSTRUCTIONS.

July 1, 1908, balance unexpended	$1, 413. 59
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10, 000. 00
	11, 413. 59
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2, 655. 25
July 1, 1909, balance unexpended	8, 758. 34
July 1, 1909, outstanding liabilities	455. 00
July 1, 1909, balance available	8, 303. 34

---

[a] Not including $55.56 spent for the Isthmian Canal Commission and subsequently returned to the appropriation; also not including $17.35, refundment of an overpayment.

[b] See consolidated money statement on page 413.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CONSOLIDATED.

July 1, 1908, balance unexpended		$161,652.13
June 30, 1909, receipts from sales		408.00
Amount appropriated by sundry civil act approved March 4, 1909		200,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		110,000.00
		472,060.13
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$100,000.00	
For maintenance of improvement	178,079.75	
		278,079.75
July 1, 1909, balance unexpended		193,980.38
July 1, 1909, outstanding liabilities		75,000.00
July 1, 1909, balance available		118,980.38
July 1, 1909, amount covered by uncompleted contracts		4,000.00
Amount (estimated) required for completion of existing project		77,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		210,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix R 1.)

2. *Mobile bar, Alabama.*—Mobile bar is located in the Gulf of Mexico off the entrance to Mobile Bay. This bar had a depth of 23 feet at low water over ample width before any work of improvement was commenced upon it. This depth accommodated all the traffic of the Mobile Bay ship channel, but was not sufficient to permit of the utilization of the deep anchorage in lower Mobile Bay beyond the southern limit of the dredged cut leading to the city of Mobile.

The original and existing project for this improvement was adopted in the river and harbor act of June 13, 1902, and provides for the formation of a channel 30 feet deep at low water and 300 feet wide across Mobile bar, at an estimated cost of $91,250. This work of improvement formed a part of the Mobile Harbor project until March 3, 1905, when, by the river and harbor act of that date, it was made a separate project, and the limit of cost was increased to $100,000.

Up to June 30, 1909, the sum of $156,443.49 had been expended on this improvement, of which about $66,443.49 was applied to maintenance.

During the fiscal year the U. S. dredge *Charleston* was engaged about all of her working time removing shoals and increasing the depth and width of this channel. The depth now ranges from 30 to 35 feet at mean low water, except on two shoals near the eastern side of the channel, where the least depth runs as low as 22 feet. The project is about 90 per cent completed.

---

[a] See consolidated money statement on this page.

The maximum draft that can be carried through the channel at mean low water is about 30 feet, and the average range of tide is 1.1 feet.

Available funds and future appropriations will be applied to completing the project and its maintenance and to keeping the dredge *Charleston* in repair.

For commercial statistics and effect of improvement on freight rates, see report on Mobile Harbor.

A reference to the report of the survey on which the existing project is based can be found in the Annual Report of the Chief of Engineers for 1904, page 324.

July 1, 1908, balance unexpended		$25,081.63
June 30, 1909, receipts from sales		4.55
Amount allotted from appropriation by river and harbor act approved March 3, 1909		23,000.00
		48,086.18
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$7,000.00	
For maintenance of improvement	24,525.12	
		31,525.12
July 1, 1909, balance unexpended		16,561.06
July 1, 1909, outstanding liabilities		8,500.00
July 1, 1909, balance available		8,061.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		18,000.00

(See Appendix R 2.)

3. *Black Warrior, Warrior, and Tombigbee rivers, Alabama*—(*a*) *Black Warrior River.*—This name refers to that portion of the Warrior River above Tuscaloosa. Originally this part of the river was practically closed to navigation on account of shoals at and above Tuscaloosa.

The original project for the improvement was adopted in 1887, the object being to obtain a channel for barges of 6 feet draft at low water all the year round between Tuscaloosa and Daniels Creek, 14½ miles above, by means of five locks and dams, at an estimated cost of $741,670.

Locks 10, 11, and 12 were built by hired labor and have been completed and opened for traffic since November, 1895.

Lock No. 13 was completed in May, 1905. The river and harbor act of March 3, 1899, provided for the construction of this lock, and extended the upper limit of the improvement to the junction of the Mulberry and Locust forks of the river, 46½ miles above Tuscaloosa.

The river and harbor act of March 2, 1907, authorized the construction of Locks 14, 15, 16, and 17, leaving Locks 18, 19, and 20 to be provided for. It was subsequently decided to build two 21-foot lift locks (Nos. 16 and 17) instead of three 14-foot lift locks, on Squaw shoals, thus reducing the number of locks in the slack-water system necessary to carry the improvement up to the Mulberry and Locust forks from 20 to 19.

The completion of four locks on this river has resulted in affording 6-foot navigation to the site of Lock 14, from Tuscaloosa, 12 miles. Locks 14 and 15 are being built under contract dated December 23, 1907. These two locks and dams are about 55 per cent completed, and lock-tenders' houses have been built at both locks.

Under date of November 28, 1908, a contract was made for the construction of Lock and Dam No. 16 and lock-tender's house. Camp houses have been erected, and a railroad is being built to the site of the lock, but actual work on the lock has not yet been commenced.

Gates for Locks 14 and 15 were built during past fiscal year, and are stored at Tuscaloosa shops; valves and special irons completed and delivered at sites; contract work continued through the year, about 50 per cent of the work being accomplished since July 1, 1908; sites for Locks 16 and 17 purchased; plans and specifications prepared for Lock 17, also plans for Locks 18 and 19.

The total amount expended on the Black Warrior River to June 30, 1909, including cost of surveys, etc., was $1,226,383.53, none of which was applied to maintenance.

Recent appropriations have been made for locks and dams on the Black Warrior, Warrior, and Tombigbee rivers as one slack-water system, and for statement of total figures for project see report (*c*) *Tombigbee River*.

The improvement of the Black Warrior River between Tuscaloosa and Daniels Creek is based upon the report of a board of engineers, dated April 2, 1887, and published in the Annual Report of the Chief of Engineers for 1887, page 1302.

For commercial statistics, see report on operating and care of locks and dams, page 423 of this report.

(*b*) *Warrior River*.—This name refers to that portion of the Warrior River below Tuscaloosa. Originally logs, snags, and overhanging trees rendered navigation impossible at low water and dangerous at boating stages. The minimum depth of channel was about 1 foot and the minimum width about 60 feet.

The original project for the improvement, adopted by the river and harbor act approved March 3, 1875, contemplated deepening the channel by jetty construction and the removal of snags and overhanging trees. The amount expended on this project from 1880 until the adoption of the present project was $319,388.30. Prior to 1880 appropriations aggregating $88,000 were expended on the Warrior and Tombigbee rivers jointly, and an account of this work may be found in the Annual Report of the Chief of Engineers for 1897, page 1679.

The present project, adopted by the river and harbor act of March 3, 1899, for the construction of six locks and dams (Nos. 4–9, inclusive, of the Black Warrior, Warrior, and Tombigbee system), with a total lift of 60 feet, and to afford a channel for barges of 6 feet draft at mean low water all the year round between Demopolis and Tuscaloosa, has been completed. The last three locks built (Nos. 4, 5, and 6) were commenced under contract in May, 1903, but after abandonment of work by the contractors on December 31, 1904, they were completed with hired labor and were opened for traffic during the past fiscal year.

The total amount expended on improvement of Warrior River under the existing project to June 30, 1909, was $2,086,445.12, of which $13,691.24 was applied to maintenance.

For commercial statistics, see report on operating and care of locks and dams.

The report of the survey upon which the present project is based is printed in the Annual Report of the Chief of Engineers for 1890.

(*c*) *Tombigbee River from the mouth to Demopolis* (*construction of locks and dams*).—The original condition of the navigable channel of this section of the river was such as to permit of steamboat navigation during high stages of water only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth about 2 feet.

For project, amount expended, etc., see report on maintenance of channel, Tombigbee River from the mouth to Demopolis.

The amount expended on work of lock and dam construction under the existing project to June 30, 1909, was $722,033.76; for construction of dredge, $40,030; and for construction of lock houses, $10,315.16.

The river and harbor act approved March 3, 1905, made an appropriation of $100,000, and provided for the further appropriation of $781,466, to be applied to the completion of Locks and Dams Nos. 1, 2, and 3, Warrior and Tombigbee rivers, Alabama, and of Lock No. 1, Tombigbee River, and the construction of Lock No. 2, Tombigbee River. It was also provided that of these sums $40,000 might be expended for the construction of a dredge and $30,000 for the construction of lock houses necessary for the operation of locks and dams in the Black Warrior, Warrior, and Tombigbee rivers.

The full amount authorized by this river and harbor act was subsequently appropriated. Provision was made in the river and harbor act of March 2, 1907, for the construction of Lock and Dam No. 3.

During the past fiscal year Lock and Dam No. 1 were completed and opened to traffic, with hired labor. At Locks Nos. 2 and 3 work was continued under contract dated December 4, 1907, consisting principally of clearing and grubbing, building cofferdams, excavation, and delivering materials and plant. Valves and special irons were built at the Tuscaloosa shops and delivered to the contractor at the lock sites. Steel gates for these locks were also built at the same shops and are stored there ready for delivery.

About 16 per cent of the work has been done at Lock No. 2 and about 8 per cent at Lock No. 3.

During the year the 12-inch hydraulic dredge *Humphreys* was completed and is in operation. Contract was made for an additional lock house at Lock No. 2, and it is about 90 per cent completed.

For commerce during the calendar year 1908, see report on Tombigbee River, mouth to Demopolis, and reference is also had to report on operating and care of locks, which furnishes statistics for the fiscal year.

General.—Recent appropriations for slack watering the Black Warrior, Warrior, and Tombigbee rivers have been made for one system of locks and dams, so that this is now considered one project, and work is in progress on the same under continuing contract authorization in river and harbor act of March 2, 1907, of which $312,000 remains to be appropriated. The estimated total cost of this work, exclusive of maintenance, is now $7,393,219.31. The increase in this estimated total cost over that contained in the Annual Report for 1908 is due to the fact that the amounts required for the completion of Locks Nos. 1, 4, 5, and 6, finished during the past fiscal year with hired labor, proved to be considerably larger than had been estimated, especially in the case of the first-named lock, where it was necessary to maintain a heavy force to insure completion of the dam before high water. The closure of the dam was made November 18, 1908. Also, experience has shown that the present type of guard cribs is too light. It is proposed to substitute a crib of wider base at Locks Nos. 1, 2, and 3, Tombigbee River, in place of those originally planned, and to reduce the intervals between successive cribs guarding the upper approaches to these locks, in order to facilitate the handling and entrance of boats.

The following statement shows the total figures for this project:

Total estimated cost of project, including $13,691.24 applied to maintenance of work		$7,406,910.55
Total amount appropriated, received from sales, etc., to June 30, 1909.		5,294,910.55
Amount authorized but not yet appropriated	$312,000	
Amount required, but not yet authorized or appropriated	1,800,000	
		2,112,000.00

The following division shows the proposed application of the required $2,112,000:

For completing all locks and dams	$1,947,000.00
For dredging between locks, necessary to obtain 6-foot depth	100,000.00
For construction of additional lock houses	25,000.00
For removing snags and overhanging trees (original work)	30,000.00
For building fishways in dams at Locks Nos. 7, 8, 9, 10, 11, 12, and 13.	10,000.00
Total amount required that has not yet been appropriated	2,112,000.00

The following shows the disposition of the amount appropriated, received from sales, etc., to June 30, 1909, in all		5,294,910.55
Applied to work of lock and dam construction, including surveys	$4,021,171.17	
Cost of dredge	40,030.00	
Cost of lock houses to June 30, 1909	10,315.16	
Snagging work (maintenance)	13,691.24	
Total		4,085,207.57
Balance unexpended June 30, 1909		1,209,702.98

It is therefore proposed to apply available funds and future appropriations to the completion of locks and dams on the Black Warrior and Tombigbee rivers, the performance of dredging, removal of snags and overhanging trees, etc., as indicated in the foregoing statement, the work immediately proposed, however, being the completion of Locks and Dams Nos. 2 and 3, Tombigbee River, and Nos. 14, 15, and 16, Black Warrior River, and the commencement of Lock No. 17, Black Warrior River, all under contract.

The work of lock and dam construction thus far accomplished has had a marked effect on traffic. Through packet service from Mobile to Tuscaloosa, which had been abandoned for many years, was resumed during the past fiscal year, and four towboats, with a number of barges, have been in use on the upper river during the past winter. Just what effect the all-year-round 6-foot navigation will have when obtained can not be definitely stated as yet, but it is expected to cause a great reduction in freight rates between the mining section of Alabama and the Gulf of Mexico.

LOCKS AND DAMS.

July 1, 1908, balance unexpended	$807,031.47
June 30, 1909, receipts from sales	575.42
Amount appropriated by sundry civil act approved March 4, 1909	1,000,000.00
	1,807,606.89
June 30, 1909, amount expended during fiscal year, for works of improvement	[a] 617,588.75
July 1, 1909, balance unexpended	1,190,018.14
July 1, 1909, outstanding liabilities	61,300.00
July 1, 1909, balance available	1,128,718.14
July 1, 1909, amount covered by uncompleted contracts	1,398,408.00
Amount (estimated) required for completion of existing project	2,112,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[b] 1,100,000.00

LOCK HOUSES.

July 1, 1908, balance unexpended	$19,684.84
July 1, 1909, balance unexpended	19,684.84
July 1, 1909, amount covered by uncompleted contracts	1,792.00

CONSOLIDATED.

July 1, 1908, balance unexpended	$826,716.31
June 30, 1909, receipts from sales	575.42
Amount appropriated by sundry civil act approved March 4, 1909	1,000,000.00
	1,827,291.73
June 30, 1909, amount expended during fiscal year, for works of improvement	617,588.75
July 1, 1909, balance unexpended	1,209,702.98
July 1, 1909, outstanding liabilities	61,300.00
July 1, 1909, balance available	1,148,402.98
July 1, 1909, amount covered by uncompleted contracts	1,400,200.00
Amount (estimated) required for completion of existing project	2,112,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[c] 1,100,000.00

(d) *Tombigbee River from the mouth to Demopolis* (*maintenance of channel*).—The original condition of the channel of this portion of the river was such as to permit of steamboat navigation during high-water stages only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth 2 feet, at mean low water.

---

[a] Not including $12.50 expended for United States Weather Bureau and subsequently returned to appropriation; also not including $65.47 expended for Isthmian Canal Commission, to be returned to appropriation.

[b] Of this amount $312,000 is for continuing contract work authorized by the river and harbor act of March 2, 1907.

[c] Of this amount $312,000 is for continuing contract work authorized by the river and harbor act of March 2, 1907.

The original project for the improvement of this stream, as adopted in 1871, contemplated the removal of snags and other obstructions in the channel of the river and the widening and deepening of the existing channel through various shoals, at an estimated cost of $21,500. The project adopted in 1879 was to afford a channel of navigable width and 4 feet deep at ordinary low water from the mouth to Demopolis, a distance of 185 miles, by the removal of snags, logs, and overhanging trees, and the improvement of the worst bars by dredging.

Prior to commencement of work under the existing project there was applied to channel work on this section of river $249,542.48.

The earlier projects for the improvement of this section of Tombigbee River were superseded by the project adopted in the river and harbor act of September 19, 1890. The project adopted at that time provided for securing a channel 6 feet deep at low water between the mouth and Demopolis by the construction of locks and dams and bank revetments, and by the removal of logs, snags, and other obstructions. The cost of this project was originally estimated at $508,808.98, but in 1897 after $330,000 had been appropriated for the work, the estimate was increased, the additional cost of completion being then placed at $600,000.

By the river and harbor act of June 13, 1902, the formation of a 6-foot channel below Demopolis by constructing locks and dams was made a part of the project for securing 6-foot navigation in the Black Warrior, Warrior, and Tombigbee rivers, Alabama. Information in regard to work accomplished on the Tombigbee River under this project and the expenditures made in connection therewith will be found in the section of this report immediately preceding.

Under previous projects this section of the Tombigbee River has been repeatedly cleared of snags, dikes have been constructed, dredging has been done at the worst bars, and the channel made navigable for steamboats at low stages of the river. The existing project for maintenance of the improvement of the Tombigbee River from the mouth to Demopolis was adopted by the river and harbor act of June 13, 1902, and contemplates the maintenance of the existing channel by the removal of logs, snags, and other obstructions from the stream, and by the repair of dikes.

The amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1909, was $51,332.17, all of which was applied to maintenance. All work under this project has been performed with the United States plant and hired labor, and the channel of the stream has been maintained in a navigable condition.

During the past fiscal year the snag boat *Demopolis* worked over about 16½ miles of this section, below Lock No. 1, removing 1,028 obstructions from the channel and doing a small amount of bank work. In addition, the wreck of an old sunken snag boat was removed.

The new snag boat *Tombigbee* was received and fitted up, and will commence work as soon as the water falls low enough. Part payment for this boat was made from this appropriation, and part cost of completing dredge for use on this and other rivers was also paid.

It is proposed to apply available funds and future appropriations to maintenance of the improvement by snagging, dredging, and construction of jetties. Two snag boats will be kept at work here.

The Tombigbee River is navigable for steamboats as far up as Columbus, Miss., a distance of 341 miles above its mouth, and for rafts as far up as Walkers Bridge, Miss., a farther distance of 169 miles. This stream is nontidal except in its lower reaches. Floods at Demopolis rise at times to a stage of 60 feet above low water.

Detailed accounts of this improvement are contained in the Annual Reports of the Chief of Engineers for 1896, page 1437; 1897, page 1685; and 1900, page 2202.

Commerce on this section of river in 1908 amounted to 300,081 tons, valued at about $4,529,739. The project results in affording cheap water rates between Mobile and points along the lower Tombigbee River.

July 1, 1908, balance unexpended	$21,933.13
June 30, 1909, receipts from sales	137.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	32,070.93
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	22,416.30
July 1, 1909, balance unexpended	9,654.63
July 1, 1909, outstanding liabilities	1,304.00
July 1, 1909, balance available	8,350.63
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	26,000.00

(*e*) *Tombigbee River from Demopolis, Ala., to Columbus, Miss.*—The original condition of this section of the river was such as to admit of navigation only during high-water stages. The channel was obstructed by shoals, logs, and overhanging trees, the minimum depth being 1 foot at mean low water, and the minimum width of channel 70 feet. The improvement of the Tombigbee River between Demopolis and Columbus was commenced under the project of 1871, which contemplated the improvement of this stream by the removal of snags and other obstructions in the river and the widening and deepening of existing channels through various bars. In 1879 this project was modified so as to provide for the formation of a channel of navigable width and 3 feet deep at low water from Demopolis to Columbus, this section forming a part of two different improvements.

Prior to adoption of the present project, $63,382.98 was expended on this section of the river.

The present project for improvement of this section of Tombigbee River, adopted in 1890, provides for securing a channel 6 feet deep at low water from Demopolis to Columbus, a distance of 156 miles, by snagging, tree cutting, bank revetment, bar improvement, and the construction of locks and dams, at a cost originally estimated at $779,400. In 1897 the construction of locks and dams was estimated to cost $2,000,000. This project was adopted by the river and harbor act of September 19, 1890, but no provision has yet been made by Congress for commencing the work of lock and dam construction. The fall of the river from Columbus to Demopolis is about 108 feet.

The total amount expended on the work under the existing project up to the close of the fiscal year ending June 30, 1909, was $178,295.38, of which about $77,838.49 was applied to maintenance. These expenditures have resulted in the formation of a clear channel within the limits of the project available for light-draft boats on a 2-foot rise above low water and in the partial maintenance of this improvement. Work has been prosecuted by means of United States plant and hired labor.

During the fiscal year about 68 miles of river were worked over with the snag boat *Vienna*, upstream from Demopolis, when interrupted by high water. Overhanging trees were cut and pulled back, and 1,588 logs, snags, and stumps were removed from the channel. This part of the river can be navigated by steamboats most of the year.

For efficient work on this section, a self-propelling snag boat is considered necessary, and the cost of such a boat has been included in estimate of amount required.

It is proposed to apply available funds and future appropriations to the work of maintaining the improvement by the removal of snags, trees, and other obstructions brought into the channel by freshets. The maximum height of these freshets at Columbus is 40 feet.

The commerce on this section of the river for the calendar year 1908 amounted to about 15,202 tons, valued at $531,128.

This project results in affording water rates from Mobile to points on the Tombigbee River above Demopolis for several months each year.

July 1, 1908, balance unexpended	$9,687.94
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,983.32
July 1, 1909, balance unexpended	3,704.62
July 1, 1909, outstanding liabilities	570.00
July 1, 1909, balance available	3,134.62
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	26,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*f*) *Tombigbee River from Columbus to Walkers Bridge, Miss.*—Prior to 1902 this improvement was divided into two sections, one from Columbus to Fulton, 144 miles, and the other from Fulton to Walkers Bridge, 25 miles, for which appropriations were made separately.

The original condition of the river was such that navigation was impossible except at high water, and difficult even at that stage, owing to the logs, snags, and overhanging trees which obstructed the channel. The minimum depth in the channel was about 1 foot at mean low water and the minimum width was 50 feet.

The project for the improvement of the river above Columbus was adopted in 1873, and provided for obtaining a good high-water channel by the removal of obstructions, at an estimated cost of $35,000. This project was completed in 1882, at a cost of $27,293.65, since which time operations have been directed toward maintaining the improvement. The first specific appropriation for the portion of the river between Fulton and Columbus was made in 1892, this money, together with subsequent appropriations, being applied to the maintenance of a high-water channel.

The project for improvement of the river from Fulton to Walkers Bridge was adopted in 1888, and provides for securing a high-water channel by the removal of logs, snags, and overhanging trees, at an estimated cost of $11,000, and for the maintenance of the same at an annual cost of $1,500. This project was adopted by the river and harbor act of August 11, 1888, and was completed in 1891, at a cost of $6,517.19.

The total amount expended on these projects up to the close of the fiscal year ending June 30, 1909, was $77,725.20, of which amount $43,914.36 had been applied to maintenance. United States plant and hired labor have been employed on this work.

The limited amount available for work on this section of the river for a number of years has limited operations to short stretches of river in worst condition, but it is desired to make the operations more extensive, maintaining two working parties in the field instead of one, with a view to getting over the entire section in one working season.

During the past fiscal year no work could be done until June 17, 1909, owing to lack of money. On this date work was commenced just below Fulton, Miss., working downstream. About 18 miles of river was worked over during the balance of the month, though the river was a little too high for thorough work and parts of this stretch may have to be worked over again at a lower stage; 102 obstructions were removed from the river, in addition to bank work. These operations are being carried on with funds allotted from the appropriation of March 3, 1909.

As a result of the work done on this section of Tombigbee River it has been possible to bring large rafts of logs and timber down on a rise of a few feet above low water, but the freshets here range from 20 to 40 feet during the high-water season and many obstructions are brought into the stream by these floods, rendering it necessary to remove such obstructions each season in order to keep the channel open. This part of the river is nontidal.

It is proposed to apply available funds and future appropriations to the work of maintaining a high-water channel within the limits of the improvement.

A reference to reports on surveys upon which a portion of this project is based is printed in the Annual Report of the Chief of Engineers for 1905, page 340.

The commerce on this section of the river during the calendar year ending December 31, 1908, amounted to 22,834 tons of logs, valued at $120,181.

Funds for work on this part of the river are allotted from the appropriation for Tombigbee River, Demopolis to Columbus.

This project has no effect on freight rates.

July 1, 1908, balance unexpended	$71.14
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	3,071.14
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	129.29
July 1, 1909, balance unexpended	2,941.85
July 1, 1909, outstanding liabilities	330.00
July 1, 1909, balance available	2,611.85
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R 3.)

4. *Operating and care of locks and dams on Black Warrior and Tombigbee rivers, Alabama.*—(*a*) *Lock 1.*—This lock is about 110 miles above Mobile, and was opened for traffic on September 6, 1908, though all construction work was not completed on that date. On December 1, 1908, its operation and care became a charge under the general law of July 5, 1884.

During the past year a movable boom has been constructed above the lock to prevent lodgment of drift during high water; tanks for supplying drinking water were installed; some dredging was done in lock chamber and approaches; system of lighting lock was installed; and some stone delivered for extending riprap bank protection.

(*b*) *Lock 4.*—This lock is near Demopolis, Ala., about 231 miles above Mobile. Construction work was completed and the lock opened for traffic on December 1, 1908. At that time its operation and care became a charge under the general law of July 5, 1884. The lock has been used regularly for traffic whenever the water was too low for boats to pass over the dam. Lock-tender's house has been painted, fence built around reservation, riprap bank protection extended, and some stone delivered for further work on bank protection.

(*c*) *Lock 5.*—This lock is about 246 miles above Mobile. Construction work was completed and this lock opened to traffic September 1, 1908. At that time its operation and care became a charge under the general law of July 5, 1884. Lock-tender's house has been painted, fence built around reservation, riprap bank protection extended, and considerable filling placed below dam.

(*d*) *Lock 6.*—This lock is about 267 miles above Mobile. Construction work was completed and the lock opened for traffic on October 1, 1908. At that time its operation and care became a charge under the general law of July 5, 1884. Fence has been built around reservation, riprap bank protection extended, stone filling placed below dam, and derrick stone delivered to be placed on dam apron during the next low-water season. Flood deposit has been dredged from lock approaches.

(*e*) *Lock 7.*—This lock is about 282 miles above Mobile. Contract work was completed and the lock turned over to the United States November 7, 1903. At that time its operation and care became a charge under the general law of July 5, 1884.

The lock was opened for traffic November 27, 1903, and has been used regularly since. During the past year one of the guide cribs on upper approach was undermined and turned over. All of the stone and part of the timber for replacing this crib with a larger one have been delivered. Flood deposit has been dredged from lock and approaches.

(*f*) *Lock 8.*—This lock is about 298 miles above Mobile. Contract work was completed and this lock turned over to the United States in December, 1902. On January 1, 1903, its operation and care became a charge under the general law of July 5, 1884. On account of delay in erecting the gates, damage to timber floor by upthrust, and a large leak which developed under abutment, this lock was not opened for traffic until October 13, 1903. Since that time it has been used regularly, except twenty-six days during 1904, when it was closed for repairs, and four days in 1906, when upper approach was filled with drift and saw logs. No work except operating and care has been done during the past year.

(*g*) *Lock 9.*—This lock is about 315 miles above Mobile. Contract work was completed and the lock turned over to the United States in December, 1902. On January 1, 1903, its operation and care became a charge under the general law of July 5, 1884. This lock was opened for traffic in October, 1902, and has been used regularly since. During the past year some stone has been filled below dam to check erosion, flood deposit dredged from locks and approaches; bridge on wagon road to lock has been rebuilt, and some repairs have been made to riprap bank protection.

(*h*) *Locks 10, 11, and 12.*—These locks and dams are near Tuscaloosa, Ala., about 362 miles above Mobile, and overcome the Tuscaloosa Falls with their combined lift of 29 feet.

They were finished and opened for traffic in November, 1895, and on July 1, 1896, their operation and care became a charge under the general law of July 5, 1884. During the past year 1,949 tons of quarry waste have been filled above these three dams to prevent leakage, and flood deposit has been dredged from the locks and approaches.

(*i*) *Lock 13.*—This lock is about 9 miles above Tuscaloosa, and about 370 miles above Mobile. Contract work was completed and the lock turned over to the United States in May, 1905. Erecting the gates was completed and the lock opened for traffic on July 4, 1905, when its operation and care became a charge under the general law of July 5, 1884. During the past year some dredging was done in lower approach to lock, and wreck of an old coal barge was blasted and removed from channel below lock.

(*j*).—During the past year, in addition to work on locks, the worst snags were removed from about 52 miles of river. Channels were dredged through three of the worst bars on the river. One new work barge has been built. Gasoline towboat *Sylph* has been rebuilt. Snag boat *R. C. McCalla*, which was built under contract and partly paid for from this allotment, was completed and delivered at Mobile. This boat was put in commission on the Black Warrior River on May 20, and is now at work removing numerous snags and trees that caved from the banks during the recent high-water season. Pipe line and pontoons for new 12-inch hydraulic dredge have been fitted up and this dredge used in clearing flood deposit from lock approaches. New gasoline engine installed on launch *Mamie K.* Four barges hauled out on ways and thoroughly repaired. Dredging machinery moved off wooden hull and fitted up on steel barge. Building cabin on this hull is now in progress. Wooden hull that had been used for dredge pulled out on ways and repaired and fitted up as a quarterboat. Derrick boat hauled out on ways and repairs to same are now in progress.

To June 30, 1909, the amount expended on this work was $433,917.29.

The total expense during the year, for operating, repairs, etc., for the 11 locks, was $90,776.78.

The commerce passing through the locks during the fiscal year ending June 30, 1909, amounted to 1,102 tons cement, 6,177 tons coal, 4,771 tons corn, 5,291 tons cotton, 2,530 tons cotton seed, 2,414 tons fertilizer, 72,128 tons logs, 3,632 tons lumber, 10,148 tons staves, 28,393 tons stone, 13,350 tons sand and gravel, and 15,178 tons miscellaneous freight.

In addition to the traffic through the locks there was considerable traffic in coal, cement, and contractors supplies on the pool above Lock 13, and some coal traffic in the pool between Locks 12 and 13. There is also a very large traffic in logs, timber, general merchandise, cotton, sand, and gravel on the river below Lock 1.

(See Appendix R 4.)

5. *Pascagoula River, Mississippi.*—Before this improvement was commenced the channel through the bar at the mouth of the river had a least depth of 3 feet at mean low water, while inside the mouth for a distance of 10 miles upstream the river was navigable for vessels of 6½ feet draft. Appropriations for this work of improvement were made in 1827, 1828, and 1852, but there is no record of the work accomplished with those funds.

The first extended project for the improvement of this stream was adopted in 1880 and contemplated securing a channel 7 feet deep and 200 feet wide across the bar at the mouth of the river. This project also included some snagging work on the river above Moss Point, which is described in the report on the improvement of the Pascagoula, Leaf, and Chickasahay rivers, Mississippi. The project for a 7-foot channel was practically completed in 1884, the total amount expended in securing such a channel, including the appropriations made between 1827 and 1852, amounting to $74,500.

In 1886 a new project was adopted, which provided for securing a channel 12 feet deep at low water, with a navigable width between Mississippi Sound and Moss Point. Under this project a depth of 9 feet across the entrance bar was first obtained, while subsequently a channel 12 feet deep and 80 feet wide was dredged from Moss Point to the mouth of the river, and a 12-foot channel across the bar at the mouth was partially completed. These operations required the expenditure of $95,000, including the expenditure of about $8,000 applied to dredging work in Horn Island Pass in 1897, or a total of $169,500 under both projects.

The present project for the improvement of Pascagoula River was adopted in the river and harbor act of March 3, 1899, and provided for the formation of a 12-foot channel from a point in Dog River 3 miles above its mouth down the Pascagoula River to the 12-foot contour in Mississippi Sound, 150 feet wide above and 300 feet wide below the railroad bridge at Scranton, Miss., at an estimated cost of $317,600, including the formation of a 20-foot channel through certain shoal spots in the Horn Island anchorage.

Work under this project was in progress between September, 1899, and February, 1902, during which time an uninterrupted 12-foot channel was obtained within the limits of the project in Pascagoula River, while a 20-foot channel was formed through the shoal areas in Horn Island anchorage.

The river and harbor act of June 13, 1902, modified and extended the existing project so as to provide for a channel 17 feet deep instead of 12 feet from 3 miles above the mouth of Dog River to Mississippi Sound, at a total cost of $1,050,222, exclusive of the Horn Island improvement.

The total amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $674,651.13, excluding the expenditure of about $88,000 on the work performed at Horn Island. Of this amount $155,081.14 was applied to maintenance. Work under the project is about 60 per cent completed.

During the past fiscal year contract work was carried on here, removing 442,556 cubic yards of material from about 22,579 feet of channel, and dredging operations were also carried on with the U. S. dredge *Barnard*, this dredge removing 586,353 cubic yards of material from 12,647 feet of channel, all dredging being to more than 17 feet depth at mean low water. About one-fourth of this work was original dredging and the balance for the purpose of maintenance.

The available draft is now 18 feet at mean low water. The average range of tide is 1¾ feet.

It is proposed to apply the available balance and future appropriations toward the completion of the project and maintenance of the improvement.

A reference to the report of the survey upon which the existing project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 334. An account of this improvement is contained in the Annual Reports for 1902, page 2211, and 1904, page 1828.

The commerce of the harbor for the calendar year 1908 amounted to 1,184,569 tons, principally logs, lumber, and naval stores, valued at $7,216,460.

This project results in effecting a reduction in rail freight rates between Scranton, Miss., and seaboard cities of the Atlantic coast, and also in affording direct water freight rates on lumber from Moss Point and Scranton to foreign ports.

July 1, 1908, balance unexpended		$125,607.33
Amount allotted from appropriation by river and harbor act approved March 3, 1909		75,000.00
		200,607.33
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$30,622.00	
For maintenance of improvement	90,036.46	
		120,658.46
July 1, 1909, balance unexpended		79,948.87
Amount (estimated) required for completion of existing project		330,000.00

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 .... $100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix R 5.)

6. Pascagoula, Leaf, and Chickasahay rivers, Mississippi.—(*a*) *Pascagoula River* (*above the mouth of Dog River*).—Before this improvement was commenced navigation was impossible on this section of Pascagoula River except during periods of high water. The minimum width of the channel was 60 feet and the minimum depth was 1 foot at mean low water, the stream being very much obstructed by snags and logs. The first project for this improvement, which was adopted in 1880, in addition to providing for dredging work at the mouth of the stream, described in the report on the improvement of Pascagoula River, Mississippi, contemplated the improvement of the river by the removal of snags and overhanging trees. Under this project the river was cleared of obstructions between 1882 and 1884, at a cost of $15,000. In 1886 the existing project for this improvement was adopted. This project provided for the maintenance of the channel above the mouth of the river by removal of obstructions from the stream from time to time, but was modified in 1899, the extent of the improvement being limited at that time to the section of the river above Dog River, about 100 miles. The total amount expended on the existing project to June 30, 1909, was $29,380.97, all of which was applied to maintenance.

No work was done on the river during the past fiscal year, the expenditures being in payment of part of the cost of a new sternwheel snag boat and of a small amount of office expenses. The new snag boat built will be occupied most of its time on the Tombigbee River, where she is operating now, and while she can be operated on Pascagoula River, she is not suitable for the work on Leaf and Chickasahay rivers. So it is proposed to apply available funds and those estimated for fiscal year 1911 for the Pascagoula, Leaf, and Chickasahay rivers (see consolidated money statement) to the construction of a small self-propelling snag boat especially suited to the work on these three rivers, and to the operation of this boat in maintenance of the improvement. This, it is considered, will be much the most economical and efficient plan for maintaining the three channels.

On June 30, 1909, the Pascagoula River was navigable at low water for boats of 5 feet draft as far up as Cedar Creek, 55 miles, while above this point to the head of the river light-draft navigation was possible on a slight rise above low water.

The Pascagoula River is nontidal, except in its lower reaches.

The report of the examination upon which the improvement was originally based is printed in the Annual Report of the Chief of Engineers for 1879, page 835.

The commerce originating on Pascagoula River above the mouth of Dog River during the calendar year 1908 amounted to 290,327 tons, principally logs, naval stores, and general merchandise, valued at $1,807,500. In addition to this, the combined commerce of Chickasahay and Leaf rivers passed over this stream.

This project has no effect on freight rates.

Available funds and future appropriations will be applied to part payment on snag boat and in continuation of snagging operations.

July 1, 1908, balance unexpended	$9,446.53
June 30, 1909, amount expended during fiscal year for maintenance of improvement	6,077.50
July 1, 1909, balance unexpended	3,369.03
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	(a)

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(b) *Leaf River.*—Originally it was impracticable to navigate this river on account of snags, logs, and overhanging trees obstructing the channel. The minimum width of the stream was 100 feet and the minimum depth was 2½ feet at mean low water. The original project for this improvement was adopted in 1890, its purpose being to afford a channel for high-water navigation from Bowie Creek to the mouth of the river, a distance of 75 miles, by the removal of obstructions and overhanging trees. This project was completed in 1897 at a cost of $11,019.04, since which time expenditures have been in the direction of maintaining the improvement.

No work was done during the fiscal year, the expenditures being applied to part payment for construction of a self-propelling snag boat, now employed on Tombigbee River. With the funds now available and those estimated for 1911, it is proposed to pay part of the cost of a small snag boat to be built for Pascagoula, Leaf, and Chickasahay rivers, and to maintain the improvement.

The total amount expended on this improvement up to June 30, 1909, was $23,146.01, of which $12,126.97 was applied to maintenance.

On June 30, 1909, the river was available for rafting on a fair rise above low water, being used to a very limited extent for any other form of navigation.

For reference to the report upon which this project is based and to descriptions of the improvement, see the Annual Report of the Chief of Engineers for 1904, page 337.

The commerce of Leaf River during the calendar year 1908 amounted to 213,300 tons, principally logs and timber, valued at $636,000.

This project has no effect on freight rates.

July 1, 1908, balance unexpended	$3,416.49
June 30, 1909, amount expended during fiscal year for maintenance of improvement	1,062.50
July 1, 1909, balance unexpended	2,353.99
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	(a)

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(c) *Chickasahay River.*—The original condition of this river was such that it was navigable for small rafts only during high water, and even navigation of this character was troublesome and dangerous. The minimum width of the channel was 50 feet and the minimum depth 6 inches at mean low water, the river being badly obstructed by logs and snags.

---

[a] See consolidated money statement on page 429.

The original project for the improvement was adopted by the river and harbor act of September 19, 1890, and provided for obtaining a high-water channel from the mouth of the river up to Shubuta, Miss., a distance of 130 miles, by the removal of obstructions from the channel and overhanging trees from the banks. The river and harbor act of June 3, 1896, modified this project by limiting the improvement to that part of the river between the mouth and Bucatunna, Miss., about 75 miles. The project further provided for the maintenance of the improved channel. The project, as modified, was completed in the latter part of 1896, at a cost of $12,399.73.

The existing project was adopted in the river and harbor act of March 3, 1905, and provides for maintaining the channel in Chickasahay River from the mouth to Bucatunna, Miss., by the removal of logs, snags, and other obstructions from the waterway, in order to keep the river in navigable condition for rafting at high-water stages, at an annual cost of $2,500. A reference to the report of the examination upon which this project is based is printed in the Annual Report of the Chief of Engineers for 1905, page 346.

No expenditures were made during the past fiscal year.

With available funds and the amount estimated for 1911 it is proposed to maintain the improvement, including the payment of part cost of a small snag boat suitable for the work on these streams.

The total amount expended on the improvement up to June 30, 1909, was $24,877.46, of which $12,477.73 was applied to maintenance.

This stream is nontidal, and its condition on June 30, 1909, was such that it could be used by flatboats and rafts on a rise of 6 or 8 feet up as far as Shubuta, Miss., though considerably obstructed.

The improvement has had no effect on freight rates.

The commerce of this river during 1908 amounted to 180,125 tons of logs and timber, valued at $923,000.

July 1, 1908, balance unexpended	$372.54
July 1, 1909, balance unexpended	372.54
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CONSOLIDATED.

July 1, 1908, balance unexpended	$13,235.56
June 30, 1909, amount expended during fiscal year for maintenance of improvement	7,140.00
July 1, 1909, balance unexpended	6,095.56
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	27,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R 6.)

---

[a] See consolidated money statement on this page.

7. *Horn Island Pass, Mississippi.*—The channel through the bar had before improvement a depth which increased through natural causes from 14 or 15 feet in 1853 to about 18 feet in 1886, and has been available at low water since the latter date for vessels up to a draft of slightly less than 18 feet at mean low water.

Under the appropriations for improving Pascagoula River, Mississippi, carried by the river and harbor acts of August 18, 1894, and June 3, 1896, provision was made for the removal of the bar in Horn Island Pass, and in conformity with this provision a channel with a least depth of 20.5 feet (19.5 feet referred to the existing datum), and with a width of 200 feet, was dredged through the Horn Island bar. The total cost of this work was $7,682.40, but the benefit of the improvement was soon lost through shoaling.

Under the appropriations for Pascagoula River and Horn Island Harbor carried by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, an amount estimated at about $88,000 was applied to dredging a 20-foot (19 feet present datum) channel at certain shoal areas in the Horn Island anchorage basin, the work being in progress between 1899 and 1901.

The existing project for the improvement of Horn Island Pass provides for the formation of a channel 21 feet deep at low water, 300 feet wide through the outer bar, and 200 feet wide elsewhere in the pass, at an estimated cost of $40,480, and $9,000 annually to preserve the improvement. The project was adopted by the river and harbor act of March 3, 1905, which carried an appropriation of $40,480 for the work, subject to the condition "that a contract or contracts can be made at a sum not to exceed the unit price of 11 cents per cubic yard, or such work can be performed by a government dredge."

The proposed dredging work was advertised under date of May 16, 1905, but no bids for its execution were received in response to this advertisement. Since that date the work has been performed by the U. S. dredge *Charleston*, completing the project and maintaining the same.

No work has been done at Horn Island Pass during the past fiscal year, the last work being in April, 1908. The expenditures have been applied in part payment for extensive repairs to the *Charleston*, which dredge will be used during part of the ensuing fiscal year in removing shoals that have formed in Horn Island Pass since the last work done here, in maintenance of the improvement. A small amount of office and engineering expenses have also been paid from this appropriation.

Available funds and future appropriations will be applied to maintenance of the present channel through the pass, including part cost of keeping in repair United States dredge for use on this and other outer bars in the district.

The report upon which this project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 1863.

The available low-water depth through the pass is about 21 feet, and the average range of tide is about 1.1 feet.

Commerce using the Horn Island Pass channel during the calendar year 1908 amounted to about 500,836 tons of lumber and timber, valued at about $4,526,960.

This improvement in connection with the improvement of Pascagoula River results in effecting a reduction in rail freight rates between Scranton, Miss., and seaboard cities of the Atlantic coast, and in affording direct water freight rates on lumber from Moss Point and Scranton to foreign ports.

The total amount expended under the existing project up to June 30, 1909, was $50,249.71, of which about $9,768.71 has been applied to maintenance.

July 1, 1908, balance unexpended	$3,493.43
Amount allotted from appropriation by river and harbor act approved March 3, 1909	12,000.00
	15,493.43
June 30, 1909, amount expended during fiscal year for maintenance of improvement	4,263.14
July 1, 1909, balance unexpended	11,230.29
July 1, 1909, outstanding liabilities	2,000.00
July 1, 1909, balance available	9,230.29
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	9,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R 7.)

8. *Harbor at Biloxi, Miss.*—This channel originally had a minimum depth of 4 feet. The original project for its improvement was adopted in 1882 and contemplated the formation of a channel through Deer Island flats to connect Biloxi Bay with the Back Bay of Biloxi, at an estimated cost of $35,000. The channel thus proposed was to have a depth of 8 feet at low water with a width sufficient for navigation.

In 1884 this project was changed so as to provide for deepening the channel from Mississippi Sound to the wharves at Biloxi from the existing depth of 4 or 4½ feet to 8 feet over a width of 150 feet, the estimated cost of this work being $55,000. The work of dredging was commenced in September, 1887, and the project was finally completed in August, 1893, at a cost of $44,382.27.

Since that time funds have been applied to the maintenance of the improvement.

No work was done here during the past fiscal year, the expenditures being in payment of part cost of building new hull for U. S. S. *Chickasaw*, and some travel expenses incurred while inspecting the improvement. The last dredging at this locality was completed in May, 1908, and considerable shoaling, especially near the edges of channel, has taken place since.

Available funds and future appropriations will be applied to maintaining a channel 8 feet deep and as great a width as possible, not exceeding 150 feet.

The commerce of the harbor during the calendar year 1908 consisted principally of lumber, rosin and turpentine, fish and oysters, and general merchandise, amounting to 217,550 tons, valued at $2,361,150.

The total amount expended on this improvement up to June 30, 1909, was $71,586.44, of which $27,204.17 was applied to work of maintenance.

The maximum low-water draft that can be carried through the channel is now about 8 feet, and the range of tide is about 1¾ feet.

A reference to the report upon which the present project for this work of improvement is based is printed in the Annual Report of the Chief of Engineers for 1904, page 337.

The project has little or no effect on freight rates.

July 1, 1908, balance unexpended	$1,298.61
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	502.78
July 1, 1909, balance unexpended	795.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix R 8.)

9. *Harbor at Gulfport and Ship Island Pass, Mississippi.*—Originally no channel existed between Ship Island Harbor and Gulfport, Miss. The depths on the site of the channel ranged from 19 to 8½ feet, and over the site of the anchorage basin they varied from 8½ to 2½ feet, at mean low water.

The existing project was adopted by the river and harbor act of March 3, 1899, which authorized the Secretary of War to enter into contract for dredging a channel 300 feet wide and 19 feet deep at mean low water from the anchorage basin at Ship Island Harbor, on the Gulf of Mexico, to Gulfport, Miss., and to construct at the end of this channel next to the shore an anchorage basin of similar depth and not less than 2,640 feet by 1,320 feet in area. This act also authorized the Secretary of War to contract for the maintenance of this channel and anchorage basin for a term of five years after their completion for the sum of $10,000 annually.

Contract was entered into in 1901 for dredging the channel and anchorage basin, the work to be completed within two years from April 21, 1901, for $150,000, and for the maintenance of the channel and basin for a term of five years after completion for the sum of $10,000 per annum. Work was commenced on April 16, 1901. By joint resolution of Congress approved June 14, 1906, it was provided that the channel and basin should be accepted as dredged, and that $150,000 should be paid the contractor for the work, the channel and basin having been dredged to the approximate depth and width required in the contract. The payment was made. The period of maintenance commenced June 14, 1906.

The river and harbor act approved March 2, 1907, appropriated $100,000 for continuing the improvement and maintenance of the anchorage basin at Gulfport and channel therefrom to the anchorage or roadstead at Ship Island, also Ship Island Pass between Ship and Cat islands, Mississippi, and authorized the Secretary of War to annul that portion of the contract entered into February 20, 1901, with Spencer S. Bullis, relating to the maintenance of a channel and anchorage basin between Ship Island and Gulfport. The annulment of this contract was effected by a supplemental agreement approved by the Secretary of War June 11, 1907.

The report of the survey upon which the improvement of Gulfport Harbor and Ship Island Pass, Mississippi, was originally based is printed in the Annual Report of the Chief of Engineers for 1899, page 1787. Reports of another examination and survey of this locality are printed in House Document No. 184, Fifty-ninth Congress, second session.

Prior to the act of March 2, 1907, appropriations were made separately for Gulfport Harbor, Mississippi, and Ship Island Pass, Mississippi. Under an appropriation of $40,000, carried by the river and harbor act of March 3, 1899, the channel through Ship Island Pass was dredged from its original depth of 21 feet to the projected depth of 26 feet and 300 feet width. These depths were 20 feet and 25 feet, respectively, referring to present datum.

The channel through Ship Island Pass has shoaled to as little as 22 feet in some spots. None of the funds appropriated March 2, 1907, were applied to this part of the work.

Of the $170,000 provided by the river and harbor act of March 3, 1909, for Gulfport Harbor and Ship Island Pass, it is proposed to apply $160,000 to maintenance work in the Gulfport channel and basin, and $10,000 to similar work at Ship Island Pass, using the dredge *Barnard* for the former work and the dredge *Charleston* for the latter. Future appropriations will be similarly applied.

During the past fiscal year the *Barnard* was employed most of her time on the work at Gulfport, removing 1,589,620 cubic yards of material, place measurement, from the channel. This dredge and attendant plant was maintained in good repair. The gross cost of the work of the *Barnard*, including repairs to plant, inspection, etc., was $59,128.79, or 3.72 cents per cubic yard.

Part of cost of repairing the *Charleston* was paid from Ship Island Pass funds.

The channel and basin at Gulfport have been maintained at projected dimensions, except in some spots where the depth is less than 19 feet, but the material composing the bottom is soft and vessels drawing 20 feet navigate the channel at mean low water, and those drawing as much as 22 feet use it at high tide. The range of the tide is about 1¾ feet.

During the time dredging work was in progress under contract with Spencer S. Bullis, allotments amounting to $24,199.85 were made from the permanent indefinite appropriation, act July 5, 1884, to cover the expenses of inspection, superintendence, and surveys. Of the amount allotted, $22,449.76 was applied to the purpose for which intended and the balance turned back into the Treasury.

The commerce of Gulfport Harbor and Ship Island Pass during the calendar year 1908 amounted to 473,327 tons, principally lumber, naval stores, and cotton, valued at $5,684,500.

This project results in effecting a reduction in rail freight rates between Gulfport and seaboard cities of the Atlantic coast and in affording water freight rates from Gulfport to foreign ports.

The total amount expended on this improvement to June 30, 1909, was $338,541.42, of which $132,645.69 was applied to maintenance. Of the above amount, $297,711.69 was applied to Gulfport harbor and channel and $40,829.73 was used on Ship Island Pass.

July 1, 1908, balance unexpended	$28,866.86
June 30, 1909, receipts from sales	101.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	170,000.00
November 9, 1908, allotted from emergency appropriation, act of March 2, 1907	10,000.00
	208,967.86
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	60,262.64
July 1, 1909, balance unexpended	148,705.22
July 1, 1909, outstanding liabilities	10,500.00
July 1, 1909, balance available	138,205.22
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	129,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R 9.)

10. Wolf and Jordan rivers, Mississippi.—The least depth on the bar at the mouth of Wolf River is something under 3 feet, and on the bar at the mouth of the Jordan River it is not quite 4 feet.

The present and only project was adopted by the river and harbor act of March 2, 1907, and provides for the formation of a channel 7 feet deep and 100 feet wide at bottom, with side slopes of 1 on 6, across the bar at the mouth of each of the streams named, from the 7-foot curve of depth in the river to the 6-foot contour in Bay St. Louis, at a cost of $30,000 for completing the work and $5,000 per annum thereafter for maintenance. After reaching the 6-foot contour in the bay the material becomes so soft that a draft of 7 feet can easily be carried through it.

During the fiscal year ending June 30, 1908, a channel 8 feet deep and 100 feet wide was dredged from the 6.7-foot curve through the bar to the 5.3-foot curve at the mouth of Wolf River, and at the mouth of Jordan River from the 6.7-foot curve through the bar to the 5.5-foot curve, completing about 95 per cent of the project.

During the past fiscal year no work was done here, but there was an expenditure of $500 as part payment for the new U. S. S. *Chickasaw*.

The channels have maintained themselves very well. Some shoaling has taken place in Wolf River, but as the shoals do not run entirely across the channel dredged the available depth remains about the same.

A mean low-water draft of 7 feet can be carried through either channel and the average range of the tide is 1¾ feet.

Additional appropriations, when made, will be applied to maintenance.

The report of the examination and survey upon which the project is based is printed in House Document No. 917, Fifty-ninth Congress, first session. For previous reports of examinations, reference is made to the Annual Report of the Chief of Engineers for 1893, pages 1787 and 1789.

The commerce on these rivers during the calendar year 1907 amounted to 55,387 tons of lumber, rosin, turpentine, and general merchandise, valued at $931,412.

The improvement has been of immediate and considerable local benefit. The work is too recent to determine its effect on freight rates, but it is believed to have little, if any, such effect.

The total amount expended on this improvement up to the close of the past fiscal year was $29,195.19, none of which was applied to maintenance.

July 1, 1908, balance unexpended	$1,304.81
June 30, 1909, amount expended during fiscal year, for works of improvement	500.00
July 1, 1909, balance unexpended	804.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R 10.)

11. Pearl River below Rockport, Miss.—The limits of this improvement originally extended from the mouth of the river to Jackson, a distance of 313 miles. By act of Congress of April 21, 1900, the construction of a fixed highway bridge across Pearl River at Rockport was legalized. This point thereby became the head of navigation on the lower river for boats of any considerable size and the upper limit of the project. However, the bridge at Rockport is reported to have been washed away in February, 1906. The distance from Jackson to Rockport is 67 miles.

Prior to improvement the condition of the river was such that it was not navigable except during high-water stages, and even then navigation was difficult and dangerous.

The original project for this improvement was adopted in 1880, and provided for a channel of navigable width and 5 feet deep at low water, by the removal of snags and sunken trees from the river bed and overhanging trees from the banks, at an estimated cost of $95,940. This project having been found to be impracticable, it was modified in 1885 so as to provide for a 2-foot channel at low water throughout this section of the river, at an estimated cost of $145,940.

With past appropriations the river has been improved until it became navigable for light-draft boats on a slight rise up as far as Monticello, about 211 miles above the mouth. Above Monticello the river has never been navigable except on a rise of 7 feet or more.

Appropriations between 1899 and 1907 were applied to the maintenance of the lower 100 miles of river. The project has been about 33 per cent completed.

The work of equipping the snag boat *Pearl* with propelling machinery was completed. During the year the snag boat *Black Warrior* was hauled out and her hull extensively repaired, without which work she could not have lasted another season. During the time when water was low enough for work these two boats removed 2,355 logs, stumps, and snags from the river, besides cutting and pulling back overhanging trees and doing other bank work. The total distance worked over was 188½ miles of river. This work has resulted in opening the channel for navigation by light-draft boats up as far as Columbia, 155 miles above the mouth.

The total amount expended on this improvement to June 30, 1909, was $193,824.29, of which $79,900.55 was applied to maintenance.

The redredging of the 9-foot channel at the mouth of East Pearl River, as recommended in House Document No. 328, Sixtieth Congress, first session, should, it is believed, be considered a separate improvement, and none of the money for Pearl River below Rockport should be applied to it.

It is proposed to apply available funds and future appropriations to the prosecution of snagging work in completion of the project and maintenance of the improvement.

This river is nontidal except in its lower reaches.

The report upon which the project was originally based can be found in the Annual Report of the Chief of Engineers for 1879, page 879. Extended information can be found in the Annual Report of the Chief of Engineers for 1896, page 1454.

The commerce of this part of Pearl River during the calendar year 1908 amounted to 21,744 tons of logs and timber, valued at $239,696.

The project has little effect on freight rates, but when completed it is believed will cause a material reduction in these charges.

July 1, 1908, balance unexpended		$24,201.26
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		39,201.26
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$8,798.74	
For maintenance of improvement	8,815.42	
		17,614.16
July 1, 1909, balance unexpended		21,587.10
July 1, 1909, outstanding liabilities		3,500.00
July 1, 1909, balance available		18,087.10
Amount (estimated) required for completion of existing project		67,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix R 11.)

12. Pearl River between Edinburg and Jackson, Miss.—The original condition of this section of Pearl River was such that navigation was impossible, except during high water, and even at high stages it was difficult and dangerous. The minimum width and depth of the channel was 40 feet and 1 foot, respectively, between Carthage and Jackson, while above Carthage the channel had a minimum width of 30 feet and a minimum depth of 3 inches, at mean low water. This improvement was formerly divided into two sections, for which appropriations were made separately. The original project for the section from Jackson up to Carthage, 101 miles, as adopted in 1879, contemplated obtaining a clear channel of navigable width and 5 feet depth at low water, at an estimated cost of $21,000. In 1886 this project was modified so as to provide for a channel 2 feet deep, this depth being considered sufficient for the needs of navigation, and at the same time the estimate of cost was increased to $50,000. Work under this project was completed in 1893, at a total cost of $26,014.98, since which time funds have been applied to maintenance.

The original project for the part of the river from Carthage up to Edinburg, a distance of 25 miles, was adopted in 1884 and provided for the formation of a high-water channel for use during six or eight months of the year, at an estimated cost of $13,464, and for the maintenance of same at an annual cost of $500. The work of improvement under this project was completed in 1890 at a cost of $5,857.08, subsequent appropriations being applied to the work of maintenance.

The river and harbor act approved June 13, 1902, made one appropriation for this section, since which it has been considered as a single improvement and appropriations made accordingly.

During the past fiscal year snagging operations were carried on in this section of Pearl River from July 17 to December 10, 1908, when high water interrupted, and from June 1 to 30, 1909. During this time 40 miles of the river were worked over, and in addition to the bank work, such as cutting some overhanging trees, pulling back others, trimming bushes and leveling stumps, there were removed from the river channel 1,845 logs, snags, and stumps. The improvement has been maintained and is available for light-draft navigation during high-water season. For efficient work a small nonpropelling snag boat is needed here, and the cost of such a boat has been included in amount estimated as needed for this improvement.

Up to June 30, 1909, the total amount expended on this improvement was $65,986.53, of which about $34,114.47 had been applied to maintenance.

The report of the survey of Pearl River from Carthage to Jackson, upon which the present project was based, is published in the Annual Report of the Chief of Engineers for 1879, page 880, and the report of the survey of the river between Edinburg and Carthage, upon which the present project was based, is printed in the Annual Report of the Chief of Engineers for 1884, page 1287.

During the calendar year 1908 the commerce on this section of Pearl River was 418 tons of general merchandise, valued at $18,000.

The improvement has had no effect on freight rates.

July 1, 1908, balance unexpended	$2,449.69
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	5,449.69
June 30, 1909, amount expended during fiscal year for maintenance of improvement	2,136.22
July 1, 1909, balance unexpended	3,313.47
July 1, 1909, outstanding liabilities	450.00
July 1, 1909, balance available	2,863.47
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended, July 1, 1909	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix R 12.)

13. Dredge for harbors on coast of Mississippi.—The river and harbor act of March 2, 1907, authorized the Secretary of War, in his discretion, to construct a dredge for use in said harbors and the channels adjacent thereto, at a cost not exceeding $200,000, of which amount, in case such dredge were constructed, $25,000 should be taken from the appropriation for Gulfport Harbor and $50,000 from the appropriation for Pascagoula River. These amounts were transferred to the credit of the dredge, and the balance of its proposed cost, $125,000, was appropriated by the sundry civil act of May 27, 1908.

The Secretary of War on April 24, 1908, authorized the construction of this dredge.

At the beginning of the fiscal year the design of the dredge was about 90 per cent completed and that of attendant plant about 66 per cent. During the past fiscal year these plans were completed and approved and, after advertising for proposals, contracts were made for the dredge, which will be called the "*Pascagoula*," at a cost of $144,000, and for pontons for the pipe line for $9,120.22, both to be delivered at Scranton, Miss. The tug *Tuscaloosa* was also purchased at a cost of $21,500. Other items of plant have been ordered, such as pipe for the pipe line, and attendant launch and coal barge. The dredge is over 80 per cent completed and the pontons over 70 per cent. It is expected that the *Pascagoula* will start from Baltimore, where she is being built, for Scranton, Miss., about the 20th of July, 1909.

The total amount expended on this work to June 30, 1909, was $116,115.13.

July 1, 1908, balance unexpended	$200,000.00
June 30, 1909, receipts from sales	2.10
	200,002.10
June 30, 1909, amount expended during fiscal year, for works of improvement	116,115.13
July 1, 1909, balance unexpended	83,886.97
July 1, 1909, outstanding liabilities	32,000.00
July 1, 1909, balance available	51,886.97
July 1, 1909, amount covered by uncompleted contracts	38,020.22

(See Appendix R 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—On May 25, 1906, an allotment of $3,800 was made from the indefinite wreck appropriation for the purpose of removing an old sunken dry dock from Mobile River at the foot of Selma street, Mobile, Ala. A former allotment was made for the removal of this old dock in 1893, but funds became exhausted before any great part of the work had been accomplished.

With the allotment of May 25, 1906, the wreck was completely removed, exhausting the allotment. The work was finished in December, 1908.

(See Appendix R 14.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated October 21, 1907, and October 1, 1908, on preliminary examination and survey, respectively, of *Biloxi Harbor, Mississippi, with a view to extending and deepening the channel into the harbor and around the eastern end of the peninsula into the sheltered waters of Back Bay*, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1088, Sixtieth Congress, second session. The locality is not considered worthy of further improvement by the General Government at the present time in the manner proposed.

IMPROVEMENT OF RIVERS AND HARBORS IN THE NEW ORLEANS, LOUISIANA, DISTRICT.

This district was in the charge of Col. E. H. Ruffner, Corps of Engineers, division engineer, Gulf division, to August 20, 1908, and of Lieut. Col. Lansing H. Beach, Corps of Engineers, division engineer, Gulf division, since that date, having under his immediate orders, from August 29, 1908, to February 26, 1909, First Lieut. Wildurr Willing, Corps of Engineers, and First Lieut. R. R. Ralston, Corps of Engineers, since January 6, 1909.

1. Southwest Pass, Mississippi River.—On February 17, 1898, Congress allotted $10,000 from the appropriation for closing crevasse in Pass a Loutre, Mississippi River, for the purpose of a survey and report by a Board of Engineer officers upon the practicability of securing a channel of adequate width and 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass, Mississippi River. The survey was completed in 1898 and report submitted on January 7, 1899. This report is printed in the Annual Report of the Chief of Engineers for 1899, page 1863.

The item in the river and harbor act approved March 3, 1899, making appropriation for improving outlet of the Mississippi River provided for the appointment of a Board of Engineers to prepare a project for a channel 35 feet in depth throughout Southwest Pass and appropriated $20,000 for expenses of the Board. The Board of Engineers appointed under provisions of this act submitted a report and project on January 11, 1900. The report is printed on pages 2287-2302 of the Annual Report of the Chief of Engineers for 1900.

The project of the Board contemplated securing a channel 1,000 feet wide and 35 feet deep at mean low water throughout the Southwest Pass by dredging; the construction of two jetties to maintain the channel; the construction of sills across Cubits Gap, The Jump, and Baptiste Collets Canal; the closing of all minor outlets below the forts; the construction of a dredge in addition to the one provided for by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, under appropriation for improving outlet of the Mississippi River; other necessary plant, such as tugboats, barges, tracks, buildings, etc., and the purchase of land at the shore ends of the jetties; the whole estimated to cost $6,000,000, and $150,000 additional per annum for maintenance.

This project was adopted by the river and harbor act of June 13, 1902, which authorized material modifications in the plans of the jetties, and they are now located as shown on the map printed with Appendix S 1 of this report.

The original project for the expenditure of the funds appropriated for this work contemplated the construction of a dredge, dredging, purchase of land, and construction of two jetties to be built of mattresses and stone with concrete superstructure.

All of the land below or south of Pilottown, on the east bank, and all that below the United States reservation on the west bank of Southwest Pass, containing about 1,275 acres, were acquired on July 10, 1903, for use in connection with the work.

Contract was entered into July 16, approved July 31, 1903, for construction of the two jetties. The laying of foundation mats in the east jetty was commenced on December 31, 1903, and in the west jetty on August 30, 1904. The work under this contract was completed on January 5, 1908.

On account of the advance of the crest of the bar at Southwest Pass since the date of the survey of 1898, on which the estimates for this improvement were based, it became necessary to make provision for increasing the length of the jetties to correspond with this advance. This was done by supplemental contract dated July 18, 1905, the increased cost of the jetties on this account being estimated at $465,000. June 30, 1909, the jetties were completed; sills across Cubits Gap, The Jump, and additions to sill across the head of Pass a Loutre completed; coaling station and wharf at Burrwood completed; steel frame building 30 feet by 240 feet completed, and machines and ice plant installed therein now in operation.

Nine of eleven principal outlets from Southwest Pass into adjacent bays were closed by sheet-piling dams and five minor outlets closed.

The construction of 16 dwellings and one office building was commenced May 5, and is still in progress.

Dredging by contract was completed December 24, 1908, and that by government dredges continued.

By act of May 28, 1908, Congress authorized the use of funds from this appropriation in dredging shoals in the river between Cubits Gap and Head of Passes, when necessary to secure a depth of 35 feet with a practical width. The sum of $3,500,000 had been appropriated, and the river and harbor act of March 2, 1907, appropriated $1,000,000 additional, and authorized contracts to the further amount of $1,500,000, which was appropriated by sundry civil acts of May 27, 1908, and March 4, 1909. The river and harbor act of March 3, 1909, appropriated $275,000 and authorized that the sum of $600,000, or as much as may be necessary of the funds appropriated and authorized, be applied, in the discretion of the Secertary of War, to the construction of a suitable dredging plant.

In September, 1904, the available depth at mean low water was 8 feet.

In June, 1909, there was an available depth of 35 feet throughout the Pass except as follows: On the bar, a distance of 2,500 feet between the 35-foot contours, with least depth of 22 feet; at mile 18, a distance of 300 feet, with least depth of 34 feet; at mile 13, a distance of 2,500 feet, with least depth of 26 feet.

Usual variations of water surface, 1.5 feet.

The length of Southwest Pass from its head to the present sea ends of the jetties is 19 miles.

The amount expended on this work to June 30, 1909, was $4,590,604.99.

The amount of money available and pledged and not covered by contracts at the end of the fiscal year is about sufficient to cover the cost of dredging with two dredges, expenses of administration and inspection, and reasonable contingencies. As recognized by the Board on Southwest Pass in its report of January 11, 1900, and as since borne out by experience, this work is "one more than ordinarily liable to special difficulties which do not admit of calculation, such as the effect of storms, unfavorable foundations, and uncertain action of the river current," and the amount of funds available for contingencies should be unusually large.

It is proposed to apply the additional appropriation asked for to the prosecution of dredging operations, by contract and otherwise, as may be found most economical and advantageous to the United States, with a view of obtaining a minimum depth of 35 feet at mean low tide, as contemplated by the original project; to the removal of the Eads sill at the head of the pass; to the construction of the plant that will be necessary in the maintenance of the improvement, and to the payment of other expenses pertaining to the general work of improvement under the approved project.

Rules and regulations for the navigation of Southwest Pass, Mississippi River, were prescribed May 29, 1909, by the Secretary of War, in pursuance of the provisions of section 5 of the river and harbor act approved March 3, 1909, to take effect and be in force on and after July 1, 1909.

July 1, 1908, balance unexpended	$1,672,845.32
Amount allotted from appropriation by river and harbor act approved March 3, 1909	275,000.00
Amount appropriated by sundry civil act approved March 4, 1909	330,000.00
Miscellaneous receipts deposited to the credit of the appropriation during fiscal year	2,745.03
Transferred by Treasury Department from appropriation for repairs and incidental expenses of light-houses, 1909, on account of coal furnished to the Light-House Department by the Engineer Corps	245.10
	2,280,835.45
June 30, 1909, amount expended during fiscal year, for works of improvement	615,682.16
July 1, 1909, balance unexpended	1,665,153.29
July 1, 1909, outstanding liabilities	34,056.75
July 1, 1909, balance available	1,631,096.54
July 1, 1909, amount covered by uncompleted contracts	56,751.03
Amount (estimated) required for completion of existing project	[a] 600,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[b] 950,000.00

(See Appendix S 1.)

---

[a] This amount is estimated to construct a dredge to be used in completing the existing project, also to be used in maintenance of the improvement.

[b] Of this amount $600,000 is for continuing contract work authorized by the river and harbor act of March 3, 1909.

2. *Maintenance and improvement of South Pass channel, Mississippi River.*—The act of Congress of March 3, 1875, amended by acts of June 19, 1878, and March 3, 1879, made provision for the construction by James B. Eads, or his representatives, of jetties and other works in South Pass to secure and maintain a channel 26 feet in depth through the pass, and through the jetties at the mouth of the pass a channel "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width." A contract was made for the maintenance of such channel for a period of twenty years.

On January 28, 1901, this contract expired, and the work of maintenance is being continued under the provisions of the emergency river and harbor act of June 6, 1900, which provides that at the termination of the contract with the representatives of the estate of James B. Eads, deceased, the Secretary of War shall take charge of and maintain the channel, jetties, and auxiliary works at South Pass, for which a sum not to exceed $100,000 per year is appropriated until otherwise provided by law.

Additional appropriations amounting to $315,000 have since been made for the purchase of land at South Pass, for dredging, and for other necessary expenses to maintain the channel with the utmost efficiency. By act of May 28, 1908, Congress authorized the use of funds from this appropriation in dredging shoals in the river between Cubits Gap and Head of Passes, when necessary to secure a depth of 35 feet, with a practical width.

Dredging operations have been carried on with United States plant and the jetties and auxiliary works have been maintained in good condition by the addition from time to time, as required, of willows, stone, piles, and waling timber.

The lands along both sides of South Pass from Head of Passes to the Gulf, containing about 6,994 acres, together with the buildings thereon, were acquired by purchase July 8, 1903, the price paid being $35,000.

Experience has shown that in order to maintain the channel with the utmost efficiency and to meet the demands of the commerce of the port of New Orleans the amount of the annual appropriation authorized by the act of June 6, 1900, should be increased. If other funds than the $100,000 provided by the act of June 6, 1900, had not been available during the past fiscal year it would have been necessary to suspend dredging operations and the work of maintaining the channel would have been considerably curtailed. During the period that it is necessary to keep South Pass open to navigation, or until the commerce is diverted through Southwest Pass by the opening of that channel to navigation, the annual appropriation should be at least $180,000. It is believed that after the Southwest Pass is opened to navigation the work of maintaining the channel through South Pass may be discontinued.

The sum of $1,028,412.26 was expended on this work from January 29, 1901, to June 30, 1909.

Comparative statement of receipts and shipments for eight years for the port of New Orleans, La.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1901	4,213,869	1,440,224	
1902	3,385,686		828,183
1903	3,062,506		323,180
1904	2,853,926		208,580
1905	3,478,976	625,050	
1906	4,023,156	544,180	
1907	3,527,097		496,059
1908	3,088,472		438,625

Since the United States took charge of the maintenance of the channel, January 29, 1901, there has been a general increase in the available navigable depth of 3 feet, the maximum draft that could be carried on June 30, 1909, being 29 feet.

The usual variation of level of water surface is from zero at the mouth to 2½ feet at the head of the pass, due to the stage of the river, and from 1.1 feet at the mouth to 0.7 foot at the head, due to tide.

No detailed data or statistics are at hand showing the effect on freight rates of the increased depth of channel. The number of deep-draft steamers has increased, and, being able to carry full cargoes, the earnings and business of the port of New Orleans have increased and the freight rates decreased. The magnitude of the commerce of the port of New Orleans is best illustrated by the tabulated commercial statistics above. These figures are necessarily incomplete, as it is impracticable to secure statements covering all the receipts and shipments for any given period. It may be safely assumed, however, that the total greatly exceeds that shown in the above comparative statement.

APPROPRIATION FOR FISCAL YEAR 1908.

July 1, 1908, balance unexpended	$14,189.18
June 30, 1909, amount expended during fiscal year	3,789.18
June 30, 1909, amount reverted to the Treasury during fiscal year	10,400.00

APPROPRIATION FOR FISCAL YEAR 1909.

July 1, 1908, amount appropriated by emergency river and harbor act of June 6, 1900	$100,000.00
June 30, 1909, amount expended during fiscal year for maintenance of improvement	89,300.60
July 1, 1909, balance unexpended	10,699.40
July 1, 1909, outstanding liabilities	2,563.90
July 1, 1909, balance available	8,135.50
July 1, 1909, amount covered by uncompleted contracts	8,135.50

APPROPRIATION, ACT OF MARCH 2, 1907.

July 1, 1908, balance unexpended	$15,802.17
June 30, 1909, amount expended during fiscal year	3,517.17
July 1, 1909, balance unexpended	12,285.00

MAINTENANCE OF SOUTH PASS CHANNEL, MISSISSIPPI RIVER (1909) (SUNDRY CIVIL ACT OF MAY 27, 1908).

July 1, 1908, balance available	$50,000.00
Transferred by Treasury Department from appropriation for repairs and incidental expenses of light-houses, 1909, on account of services rendered by Engineer Corps in making repairs to light-house wharf and beacon	97.45
Transferred by Treasury Department from appropriation for collecting the revenue from customs, 1909, on account of services rendered by the Engineer Corps in driving piles at customs wharf, Port Eads, La	44.10
	50,141.55
June 30, 1909, amount expended during fiscal year for maintenance of improvement	22,983.03
July 1, 1909, balance unexpended	27,158.52
July 1, 1909, outstanding liabilities	9,908.52
July 1, 1909, balance available	17,250.00
July 1, 1909, amount covered by uncompleted contracts	17,250.00

MAINTENANCE OF SOUTH PASS CHANNEL, MISSISSIPPI RIVER.

Amount allotted from appropriation by river and harbor act of March 3, 1909	[a]$80,000.00
July 1, 1909, balance available	80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]80,000.00

(See Appendix S 2.)

3. Examinations and surveys at South Pass, Mississippi River.—The act of Congress approved March 3, 1875, required examinations and surveys to be made at South Pass, Mississippi River, and reports upon the depth of water and width of channel secured and maintained from time to time in said channel, together with such other information as the Secretary of War might direct. Under the terms of the acts of August 11, 1888, and June 13, 1902, an annual appropriation of $10,000 is made available for this work. By act of May 28, 1908, Congress authorized the use of funds from this appropriation in dredging shoals in the river between Cubits Gap and Head of Passes when necessary to secure a depth of 35 feet, with a practical width.

Up to January 29, 1901, the work of making examinations and surveys at South Pass was carried on under the provisions of the acts of March 3, 1875, and August 11, 1888. From January 29, 1901, to June 30, 1902, examinations and surveys were made with funds appropriated by act of June 6, 1900, for maintenance of South Pass channel.

Since June 30, 1902, under the act of June 13, 1902, repeated surveys have been made of the shoaler localities in South Pass. Complete surveys of the jetty channel and of the channel beyond the ends of the jetties to deeper water in the Gulf were made each month during the fiscal year. A detailed annual survey was made of the 14 miles of channel from the main river to deep water in the Gulf.

---

[a] This amount exclusive of regular annual appropriation of $100,000.

Discharge measurements were made of each of three passes during high water.

The expenditures during the year amounted to $9,050, for services.

The total amount expended upon this work to June 30, 1909, was $331,272.97. These figures can not be taken as being absolutely accurate, because the records prior to the act of June 13, 1902, are somewhat confused and do not seem to have been kept in sufficient separate detail to show the exact expenditure for surveys in the early years of this improvement. The amount given may be accepted as within a few dollars of the actual expenditure.

Statement of expenditures on account of appropriation for examinations and surveys at South Pass, Mississippi River, from July 1, 1908, to June 30, 1909, inclusive, made in compliance with the river and harbor act of June 13, 1902.

Services	$9,050.00

APPROPRIATION FOR FISCAL YEAR 1908.

July 1, 1908, balance unexpended	$1,050.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,050.00

APPROPRIATION FOR FISCAL YEAR 1909.

July 1, 1908, amount appropriated by river and harbor act, June 13, 1902, for fiscal year 1909	$10,000.00
June 30, 1909, amount expended during fiscal year	8,000.00
July 1, 1909, balance unexpended	2,000.00
July 1, 1909, outstanding liabilities	2,000.00
July 1, 1909, total cost of operations during fiscal year	10,000.00
Amount available for expenditure in fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909	[a] 10,000.00

(See Appendix S 3.)

4. Bayou Plaquemine, Grand River, and Pigeon bayous, Louisiana.—Prior to 1867 the largest steamboats could pass through Bayou Plaquemine into Grand Lake and other connecting water routes, but at that time the police jury of Iberville Parish closed the bayou by means of a dam, shutting out the waters of the Mississippi. Grand River and Pigeon bayous were obstructed by snags, logs, overhanging trees, and sand bars.

The present project is based upon legislation by Congress, according to project and estimate submitted February 11, 1887, and provides for dredging a channel in Bayou Plaquemine 60 feet wide and 6 feet deep from deep water up to the Plaquemine dike, constructing a lock to connect the bayou with the Mississippi River, securing the mouth of the bayou from further caving, and removing obstructions from Grand River and Pigeon bayous; total estimated cost, $1,708,250, subsequently increased to $1,740,000.

The project of 1887 was modified on April 10, 1899, to allow for dredging Bayou Plaquemine to a depth of 10 feet and a width of 125 feet.

The protection of the bank of the Mississippi River at the head of the bayou was added to the improvement in 1888, and in act of

---

[a] This amount is the regular annual appropriation authorized by the river and harbor acts of August 11, 1888, and June 13, 1902.

July 13, 1892, the improvement of Grand River and Pigeon bayous was also incorporated therein.

The act of June 3, 1896, authorized continuing contracts to be made to complete the project of improvement not to exceed $1,173,250, exclusive of the amounts therein and previously appropriated. Of this amount $1,160,000 was subsequently appropriated. By act of March 3, 1905, $35,000 was appropriated for maintenance of improvements, and contracts not to exceed $100,000, exclusive of the amounts theretofore appropriated, were authorized for completing improvement. The latter amount was appropriated by sundry civil act of June 30, 1906.

The river and harbor act of March 2, 1907, appropriated $100,000 "for construction of a dredge and maintenance."

The river and harbor act of March 3, 1909, appropriated $50,000 for maintenance.

Contract for the rectification of Bayou Plaquemine under the modified project of April 10, 1899, was made July 15, 1899. To June 30, 1909, 520,460 cubic yards of material were removed in accordance with the terms of the contract. In addition, 16,500 cubic yards was removed under supplemental contract from a portion of the channel which had shoaled. A partial channel was dredged through portions of the bayou up to the dike at the bayou approach to the lock, and work was suspended on June 27, 1905, until the lock should be opened to navigation. Work of dredging was resumed at the river end of the lock April 30, 1909.

An allotment of $75,000 was made from the appropriation of 1888 for securing the bank of the Mississippi River at the head of the bayou. Five submerged spur dikes, placed at intervals of about 900 feet, with intervals protected by revetment, were completed in 1894. These dikes and revetments form a continuous protection 1,400 feet long below the site of the lock and 1,200 feet above, with an interval of 500 feet opposite the lock site left for excavating the necessary channel to the lock. On November 30, 1901, and January 29, 1902, two mattresses, 400 by 600 feet and 400 by 450 feet, respectively, were sunk in the river and heavily loaded with stone for protection of the banks near the proposed approach to the lock.

In 1891 a project for the construction of a lock was submitted, but the funds available were insufficient to warrant its commencement at that time. The Board of Engineer officers appointed to prepare plans and specifications estimated the cost of the lock at $700,000. Revised plans and specifications for the construction of the lock and approaches were approved October 27, 1897, and December 2, 1897, respectively, and a continuing contract for the work was made May 28, 1898. The work was commenced in August, 1898. Under this contract the floor and walls of the lock were completed, and miter sills, inlet pipes, and snubbing hooks placed. By direction of the Chief of Engineers the contract was annulled upon payment of the retained percentages and other items, aggregating $24,236.41. Revised plans for construction of lock gates and of the approaches to the lock, including excavation and fill, were approved on June 11, 1903.

For the approach to the lock 1.25 acres of land on the north side and 0.31 acre on the south side were purchased August 24, 1900, for $7,500.

A protection levee was built, under contract, from the northeast corner of the lock to connect with the main levee system in front of the lock. The work was completed August 8, 1902.

The contract for the lock gates was completed May 5, 1906, the gates being accepted on that date.

The contract with the Otis Elevator Company, dated November 18, 1899, for furnishing and erecting operating machinery and power house was completed August 31, 1906. The total cost of the work under this contract was $114,000.

A contract was made February 13, 1905, for constructing protection levee and making a portion of the fill behind the lock walls. The work was commenced in March, 1905, and was completed January 28, 1907. The total quantity of material placed under this contract was 39,940 cubic yards, costing $23,564.60.

A contract was made June 6, 1905, for construction of the approach at the bayou end and part of the approach at the river end of the lock. Work under this contract was commenced on October 10, 1905, and was completed in February, 1908. Under this contract there were excavated and placed behind the lock walls 65,729 cubic yards of material; 2,131 35-foot piles and 1,690 50-foot piles were driven; 9,855 cubic yards of concrete were placed in approach walls; 11 snubbing posts were placed; the total contract cost was $120,485.35.

A contract was made August 7, 1906, for excavation and construction of river approach and back fill of lock. Work under this contract was commenced in September, 1906, and at the end of the fiscal year a total of 14,600 cubic yards of earth had been moved from the old levee and placed in the protection levee at river end; 33,688 cubic yards of earth had been excavated and placed behind the lock walls, and 11,744 cubic yards had been excavated from the river approach and spoiled; 1,311 50-foot piles had been furnished and 1,100 driven; 2,643 cubic yards of concrete had been placed in approach walls, and 4,100 cubic yards of sand and gravel had been furnished. The total amount earned by the contractor was $72,382.88, of which $13,428.48 was expended during the fiscal year 1909.

By supplemental agreement dated September 28, 1908, the work of building river approach walls, and the work of driving piles, except two pile clusters, was stopped.

For maintaining the dredged channel through Bayou Plaquemine and Grand River and for removing sediment from the lock chamber the construction of a dredge was authorized by river and harbor act of March 2, 1907. In the estimate for this work it was proposed to expend $60,000 for the dredge and to operate same for two years at $15,000 per year; contingencies, $10,000.

A board appointed in May, 1907, to examine and report concerning this improvement recommended that the back filling behind lock and wing walls should be completed as soon as possible; that while it was being placed the lock walls should be tied together with steel rods and turnbuckles, and that as soon as the back filling was completed the lower lock gate should be calked and the lock filled with water and left so for at least a month, after which the lock should be emptied and the gates readjusted.

No proposals were received when bids for back filling were first opened, September 16, 1907. Placing of tie-rods was completed in October.

The Board was reconvened and renewed its recommendations that the back filling be completed as soon as possible, and recommended that additional tie-rods be placed in the vicinity of the quoins and gate recesses; also that a further appropriation of $50,000 be secured, if possible, for the completion of the lock and appurtenances.

On March 8, 1908, a supplemental contract was made with W. O. Burton & Co. for the back filling, which was commenced March 17 and completed April 28. A total of 24,203 cubic yards was placed, at a cost of $22,992.85.

On February 24, 1908, a contract was made with A. Baldwin & Co. for the extra tie-rods and turnbuckles, delivery to be completed March 17. The turnbuckles were not delivered until April 25, when the back filling was practically completed, and therefore the extra rods were not placed.

The calking of the lower gate was completed May 11, and pumping water into the lock commenced next day. It soon became apparent that the leakage under, around, and through the gate was so excessive that the dredge could not alone fill the lock, and two 18-inch siphons were installed. Later a cut was made in the levee and two 15-inch and one 18-inch pipe placed therein in order to allow direct flow of water from the Mississippi River into the forebay of the lock. On June 9 the depth of water in the lock was 43 feet, and this depth was maintained during the month for the water test recommended by the Board of Engineer officers.

This test was completed July 10, 1908, and the lock was unwatered, cleaned, and the gates readjusted. Water was let into the lock from the bayou on March 5, 1909, and from the river on March 12.

The sum of $1,704,224.45 had been expended on this improvement to June 30, 1909, including $1,000 withdrawn by the Chief of Engineers June 20, 1901, for office expenses, and $43.06, Treasury settlements April 13, 1908, and February 23, 1909, for transportation, and also including $32,318.15 expended in back filling and testing the lock in accordance with the recommendations of the Board of Engineers. Of the total amount it is estimated $17,371.66 was applied to the maintenance of the improvement.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for maintenance of channel depths in the bayou by dredging and snagging.

Comparative statement of receipts and shipments for ten years.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	111,750	22,449	
1900	88,543		23,207
1901	283,000	194,457	
1902	292,000	9,000	
1903	302,500	10,500	
1904	318,000	15,500	
1905	706,000	388,000	
1906	572,000		134,000
1907	534,744		37,256
1908	553,916	19,172	

On page 441, Annual Report of the Chief of Engineers for 1908, reference is made to reports on examinations and surveys of this stream.

July 1, 1908, balance unexpended		[a] $275,775.83
Amount allotted from appropriation by river and harbor act approved March 3, 1909		50,000.00
		325,775.83
June 30, 1909, amount expended during fiscal year:		
For works of improvement	[b] $70,000.28	
June 30 1909, amount reverting to Treasury and deposited to the credit of the appropriation for operating and care of canals, etc	169.13	
		70,169.41
July 1, 1909, balance unexpended		255,606.42
July 1, 1909, outstanding liabilities		15,453.34
July 1, 1909, balance available		240,153.08
July 1, 1909, amount covered by uncompleted contracts		140,431.05
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1907, and of section 7 of the river and harbor act of 1899.

(See Appendix S 4.)

5. *Bayou Teche, Louisiana.*—Bayou Teche is an important commercial stream of southern Louisiana, and finds its outlet into the Gulf of Mexico through Atchafalaya River. Prior to improvement it had a depth of 8 feet to St. Martinville, La., but navigation was rendered dangerous by numerous obstructions. Above St. Martinville the bayou was navigable by steamboats during high water. The project of 1870 provided for removal of obstructions from the head to the mouth of the bayou. Work under this project was carried on from 1870 to 1886, the stream being cleared of logs, snags, wrecks, overhanging trees, and a number of bars. The improvement was not permanent and other obstructions formed.

The project of 1891 provided for the removal of obstructions between St. Martinville, La., and the mouth of the bayou, a distance of about 80 miles. Work under this project has been carried on since 1891, obstructions being removed as appropriations were made.

The project was modified by the river and harbor act approved March 2, 1907, with a view to obtaining a 6-foot navigation to

---

[a] Balance unexpended from appropriations for improving Bayou Plaquemine		$273,093.98
Balance unexpended from appropriations for operating and care of canals, etc		2,681.85
Total balance		275,775.83

[b] Amount expended from appropriations for improving Bayou Plaquemine:		
As per vouchers	$67,483.20	
Treasury settlement	4.36	
		67,487.56
Amount expended from appropriation for operating and care of canals, etc		2,512.72
		70,000.28

Arnaudville, in accordance with the report submitted in House Document No. 527, Fifty-ninth Congress, first session, at an estimated cost of $111,000, by dredging, removal of snags, etc., and construction of a lock. The expenditure for a 6-foot navigation to Arnaudville is contingent upon all lands necessary for lock and dam purposes and canal feeders being deeded to the United States free of cost and upon the United States being secured against possible claims for damages resulting from the overflow of lands by reason of the lock and dam improvement or from the draining of Spanish Lake.

To guarantee the United States against any claims for overflow, bonds were issued by municipalities in St. Martins Parish to the amount of $10,000, but it was decided by the Acting Judge-Advocate-General that such bonds were invalid. An effort was made to secure bonds from responsible bonding companies, but bonds in perpetuity could not be obtained. The conditions of the act are now under consideration by the Judge-Advocate-General and Engineer Department, and it is probable that some way of fulfilling the requirement will be decided upon to permit the work to be started.

Proportion of the project completed: To June 30, 1909, no work of construction had begun. The maximum draft that can be carried is 4 feet. The variations of water level between high and low water is 12 feet (exceptional floods not included).

A deed of the land required for lock and canal feeders was forwarded to the Attorney-General for opinion as to the validity of title. It was returned approved April 23, 1909, and was recorded May 1, 1909, in Book No. 70, pages 559–563, at St. Martinville, in the parish of St. Martin, La.

To June 30, 1909, $97,567.76 had been expended upon this work, of which $10,733.46 was for maintenance and $4,293.53 for expenses of resurvey of the bayou and $82,540.77 for works of improvement.

The maximum draft that could be carried June 30, 1909, was about 4 feet. The usual variation of level of water surface is not definitely known.

The bayou is navigable to St. Martinville, 75 miles from its mouth. The effect of the project on freight rates is not positively known.

It is proposed to apply the appropriation recommended to dredging shoals and removing obstructions in the channel as far up as the proposed site of the lock, 3½ miles below St. Martinville, La., and to removal of snags, overhanging trees, and other obstructions above that point and the construction of the lock and dam.

Comparative statement of receipts and shipments for ten years.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	272,975		13,116
1900	212,109		60,866
1901	335,583	123,474	
1902	404,454	68,871	
1903	450,542	46,088	
1904	362,706		87,836
1905	701,243	338,537	
1906	706,091	4,848	
1907	580,216		125,875
1908	515,679		64,537

July 1, 1908, balance unexpended	[a] $130,510.72
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	135,510.72
June 30, 1909, amount expended during fiscal year, for works of improvement	[a] 1,578.48
July 1, 1909, balance unexpended	[a] 133,932.24
July 1, 1909, outstanding liabilities	150.00
July 1, 1909, balance available	133,782.24
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	60,000.00

(See Appendix S 5.)

6. *Inland waterway from Franklin to Mermentau, La.*—The project for this waterway was adopted by Congress March 2, 1907, and provides for a channel 5 feet deep and 40 feet bottom width, with appropriate side slopes. The channel proposed was to run from Bayou Teche near Franklin, La., to Cote Blanche and Vermilion bays by a dredged canal and existing drainage canals or bayous, thence up Schooner Bayou, thence by a dredged canal to White Lake; across White Lake, thence by a dredged canal to Grand Lake and across this lake to Lake Misere, west of the Mermentau River, at an estimated cost of $289,292, with an estimated cost for maintenance of $20,000 per year. The construction of a lock at a suitable point between Vermilion Bay and White Lake has been found necessary for the purpose of regulating the flow through the canal with a view to preventing damage to rice lands by reason of contamination of the waters of White Lake by salt water.

The act of March 2, 1907, appropriated $89,292, and contracts were authorized to complete the project not to exceed $200,000, all of which has since been appropriated.

Under the general project the right of way must be furnished without cost to the United States.

The proposed waterway must cross the right of way of the Southern Pacific Railroad, and a bridge for the service of the railroad will be necessary. The War Department has decided that the cost of this bridge must be borne by the United States.

The amount expended to June 30, 1909, is $14,183.02, for inspections of the various routes and for surveys and dredging.

The available balance and the appropriation recommended for the fiscal year 1911 will be applied to completion of dredging and maintenance of improvement, in accordance with the adopted project.

The report on the examination of the inland-waterway channel is printed in House Document No. 640, Fifty-ninth Congress, second session.

---

[a] These amounts include expenditures from and balance unexpended of allotment of $500 made January 11, 1908, from emergency appropriation of March 2, 1907:

Improving Bayou Teche	$1,540.77
Emergency	37.71

A change of the route between Vermilion Bay and the Teche was authorized by the river and harbor act of March 3, 1909.

The field work on preliminary examinations and surveys for determining the best route for this section of the canal were completed on June 11, but the selection of the route for this portion of the canal is so intimately connected with that for the deeper canal, for which Congress authorized a survey by the river and harbor act of March 3, 1909, that it must necessarily be practically determined by the latter. It would be poor policy to locate the 5-foot canal on a line which would not permit its subsequent enlargement to the 9-foot canal proposed.

July 1, 1908, balance unexpended		$182,377.08
Amount appropriated by sundry civil act approved March 4, 1909		100,000.00
Receipts from sales of blueprints during fiscal year		5.50
		282,382.58
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$7,262.44	
Amount withdrawn through Treasury settlement	5.66	
		7,268.10
July 1, 1909, balance unexpended		275,114.48
July 1, 1909, outstanding liabilities		796.32
July 1, 1909, balance available		274,318.16
July 1, 1909, amount covered by uncompleted contracts		66,976.88
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix S 6.)

7. *Mouth and passes of Calcasieu River, Louisiana.*—Prior to improvement there existed a depth of 6½ feet over the outer bar at the entrance to Calcasieu Lake. The lake was 15 miles in length, with a depth of 6 feet. The depth of water over the inner bars was 3½ feet, and from the upper bar to Lake Charles, La., the river was not less than 8 feet deep.

Under the original project of 1872, with the modification of 1881, a channel 8 feet in depth, 70 feet wide, and 7,500 feet in length was cut through the inner bars during 1874, 1882, and 1883; but this channel having shoaled to 3½ feet, it was redredged in 1886, under the project of that year, and a plank revetment to provide against refilling was commenced. The noncompletion of this revetment caused the refilling of the channel. There was expended on this project $54,158.86.

The project adopted by the act of September 19, 1890, provides for the redredging of a channel 8 feet in depth through the inner bars and revetting this channel, to construct parallel jetties of brush and stone at the entrance to the outer pass, and to dredge a channel between these jetties to a depth of 12 feet, if necessary. The total estimated cost of the jetties was $600,000.

Under this project the revetment was completed in August, 1893. A channel 8 feet deep and 50 feet wide, connecting deep water in Calcasieu Pass and Lake, was dredged in 1894, 1895, and 1898. Construction of the east jetty was carried on in 1894, 1895, and 1896, and of the west jetty in 1897. In 1900 the foundation of the west jetty was extended 1,000 feet, making its total length 3,200 feet.

By May, 1905, the channel, dredged to a depth of 8 feet in 1903 through the inner pass, had shoaled to less than 4 feet, and the revetment placed for protection of this channel had almost entirely disappeared.

The channel through the outer pass between the jetties had a depth at low tide of about 10 feet, which is ample for the present needs of navigation, considering the condition of channel through the inner pass.

Under the project for expenditure of amount appropriated by act of March 3, 1905, a survey was made from the mouth of the river to the outer pass; the channel at the inner pass was redredged to a depth of 7 feet and width of 100 feet for a length of 24,000 feet; the channel at the mouth of the river was redredged to a depth of 7 feet and width of 100 feet for a length of 10,000 feet; the entire channel through the lake was marked by creosoted pile clusters, 54 in number, at intervals of 1,500 feet; and the revetment at lower end of lake (inner pass) was rebuilt for a length of 8,230 feet. Dredging and marking channel were completed, under contract, August 25, 1906, and repairs to revetment April 6, 1907.

Project for maintenance of the improvement was adopted in act of March 2, 1907.

It is proposed to apply available funds toward the construction of a combined dredge and snag boat and to the operation of the dredge for the maintenance of the authorized depths in the channels at the mouth and passes of the river. On June 30, 1909, this boat was three-fourths completed.

The amount expended to June 30, 1909, is $636,477.99. Of this amount $582,319.13 has been expended under the present project, of which it is estimated that $120,577.81 was applied to maintenance; $0.45 was derived from refundment of overpayment, and $2.50 from sales of blueprints. The expenditures during the past fiscal year were for collection of commercial statistics, construction and inspection of boat.

The approved project provides for a channel depth of 8 feet through the bars at the head and foot of the lake, but the maximum depth in the lake is only about 7 feet. On June 30, 1909, the maximum draft that could be carried at mean low water through the shoalest part of the channel in Lake Calcasieu was 6 feet, and the usual variation of the water surface is about 1 foot.

The head of navigation in the Calcasieu River is at Jones Bluff, about 58 miles above its mouth, or 28 miles above Lake Charles, La., the depth in the channel being not less than 12 feet. The river empties into Calcasieu Lake, the length of the navigable channel through which is about 17 miles. Calcasieu Pass is about 6 miles long and connects Calcasieu Lake with the Gulf of Mexico, the least depth in the channel being about 10 feet.

The only information obtained as to the effect of the project on freight rates is statements from the secretary of the state railroad commission and from the general freight agent of the Southern Pacific Railroad, that Lake Charles and other points on this river enjoy benefits in the way of reduced freight rates, due to the fact that they are situated on navigable water.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for maintaining the authorized depths by dredging, and necessary repairs to accessory structures.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	174,651		15,366
Calendar year—			
1900	139,580		
1901	139,045		535
1902	148,483	9,438	
1903	194,155	45,672	
1904	226,216	32,061	
1905	295,067	68,851	
1906	314,235	19,168	
1907	355,795	41,560	
1908	360,252	4,457	

On page 402, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of this river.

July 1, 1908, balance unexpended	$24,928.78
Amount allotted from appropriation by river and harbor act approved March 3, 1909	8,000.00
	32,928.78
June 30, 1909, amount expended during fiscal year for maintenance of improvement	4,903.82
July 1, 1909, balance unexpended	28,024.96
July 1, 1909, outstanding liabilities	486.93
July 1, 1909, balance available	27,538.03
July 1, 1909, amount covered by uncompleted contracts	3,413.34
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	8,000.00

(See Appendix S 7.)

8. Bogue Chitto, Chefuncte River, Bogue Falia, Tickfaw River and tributaries, Amite River, and Bayou Manchac, Louisiana.—(*a*) *Bogue Chitto.*—Originally navigation on this stream was impeded by snags, logs, and overhanging trees throughout its entire length, except during very high stages of water. The minimum width of channel was 80 feet and the least depth of water 3 feet.

The present project, adopted in 1890, provided for securing and maintaining a channel 3 feet deep from the mouth of the river to Alford's bridge, near Summit, Miss., a distance of about 100 miles, by closing the west mouth and several small run-out bayous, and by the removal of obstructions and overhanging trees, at an estimated cost of $55,000.

Owing to the inadequacy of appropriations it has been possible to carry the above project only as far as Cross River, about 80 miles, which distance had to be cleared periodically to maintain the improvement. On June 30, 1900, the condition of the river permitted of navigation by light-draft boats from the mouth of the river to Cross River. Subsequent operations have been for maintenance.

The amount expended to June 30, 1909, is $27,842.54, of which amount it is estimated $12,929.94 was applied to maintenance.

Bogue Chitto is navigable in fact for a distance of about 84 miles from its mouth. The only advantage derived from the expenditures for improvement of the stream was the facilitating of the rafting of logs and timber. The maximum draft that could be carried on June 30, 1906, was about 2½ feet. The usual variation in level of the water surface between high and low water is about 11 feet. The secretary of the railroad commission of Louisiana has stated that points on this stream have no reduction in freight rates on account of water competition.

The commerce consists mainly of the rafting of logs and timber for the surrounding sawmills. No boats ply regularly on this stream.

Bogue Chitto is not considered worthy of further improvement, the results accomplished by previous expenditures being sufficient for the needs of the commerce on the stream, and in compliance with section 7, river and harbor act of March 3, 1899, discontinuance of appropriations is recommended. There were no operations during the year.

On page 394, Annual Report of the Chief of Engineers for 1906, reference is made to reports on examinations and surveys of this stream.

Amount (estimated) required for completion of existing project..........	$30,000.00

(*b*) *Chefuncte River and Bogue Falia.*—Prior to improvement of Chefuncte River, a bar, with a depth of only 4½ feet of water, obstructed the entrance to the mouth of the river. From this point to its junction with the Bogue Falia, a distance of 10 miles, the river was from 300 to 800 feet in width, with a channel of 15 feet in depth, navigable for steamers and sailing vessels, but obstructed by snags and overhanging trees. Above this point the stream is not navigable.

Bogue Falia was navigable for small steamers from point of junction with the Chefuncte to Grants Landing, 4 miles above; for sailing vessels drawing 5 feet or less, to Covington, 2 miles farther; obstructed by snags and overhanging trees. Not navigable beyond Covington.

The original project of 1880 provided for dredging through the bar at the mouth of the Chefuncte River, and for the removal of all obstructions between its mouth and Covington on the Bogue Falia, at an estimated cost of $5,460. It was modified in 1884 to permit of the construction of a breakwater to protect the channel dredged across the bar at the mouth of the Chefuncte River. Estimated cost, $1,500.

For an account of the improvements under original project and modification, see Annual Report of the Chief of Engineers for 1896, page 1485. Subsequent operations have been for maintenance.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of said boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation between Covington and the mouth of the river. On June 30, 1909, this boat was three-fourths completed.

The amount expended to June 30, 1909, is $16,970.06, of which $10,470.06 was applied to maintenance. The expenditures during the past fiscal year were for commercial statistics, construction and inspection of boat.

On June 30, 1909, the maximum draft that could be carried over the bar at the mouth of the Chefuncte River was 7 feet, the expenditures for improvement having resulted in an increase of 2½ feet in depth and 60 feet in width. The head of navigation is Covington on the Bogue Falia, about 16 miles by river from Lake Pontchartrain. The upper part of the stream is so crooked that boats 200 feet long can run only 12½ miles up the river and boats 110 feet long only 15 miles. The variation in level of water surface between high and low tide is usually about 1 foot, although winds may make a variation of as much as 3 feet.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the state railroad commission that Covington has reduced rates on account of the navigation on that river. The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations and maintenance of improvement.

On page 395, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of these streams.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	97,789		1,716
Calendar year—			
1899	156,500		
1900	86,856		69,644
1901	92,874	6,018	
1902	100,768	7,894	
1904	184,099	83,331	
1905	222,494	38,395	
1906	235,727	13,233	
1907	221,177		14,550
1908	247,887	26,710	

July 1, 1908, balance unexpended	$8,264.02
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	10,264.02
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,428.09
July 1, 1909, balance unexpended	5,835.93
July 1, 1909, outstanding liabilities	505.54
July 1, 1909, balance available	5,330.39
July 1, 1909, amount covered by uncompleted contracts	846.67

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909.. ([a])

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*c*) *Tickfaw River and tributaries, Louisiana.*—These streams—the Tickfaw, Blood, Natalbany, and Ponchatoula rivers—had a 9-foot channel, navigable for steamers and schooners for an aggregate distance of 38 miles, but obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1881, provided for the removal of obstructions as far as appropriations would permit; estimated cost, $10,230. The existing project is for maintenance of improvement, and under these two projects the work has been carried on since 1881.

All obstructing deadheads were removed from the channel from the mouth of the Tickfaw River to Springfield on the Natalbany, and a channel was dredged across a point, which had been a serious obstruction to navigation, just above Springfield.

It is proposed to apply available funds toward the construction of a combined dredge and snag boat and to the operation of this boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation. On June 30, 1909, the boat was three-fourths completed.

The amount expended to June 30, 1909, is $18,583.61, of which it is estimated $10,468.12 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, construction, and inspection of boat.

On June 30, 1909, the maximum draft that could be carried over the bar at the mouth of the Tickfaw River at mean low water was 6 feet. There is at all times water enough in the river to accommodate a draft of 10 feet. The usual tidal variation of level of water surface is about 6 inches, but winds effect a variation of from 1 to 2 feet.

Tickfaw River is navigable in fact to Kemps Landing, about 18 miles from its mouth in Lake Maurepas; Blood River to S. Tuckers Landing, about 4 miles; Natalbany River to the parish bridge just above Springfield, La., about 12 miles; Ponchatoula River to Wadesboro, La., about 5 miles. The expenditures for improvement have been confined to the removal of snags, logs, and other obstructions.

No railroad reaches these streams at any point where navigable and there is no competition in freight rates.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations and maintenance of improvement.

On page 397, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of these streams.

---

[a] See consolidated money statement on page 460.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	52,961		22,681
Calendar year—			
1899	79,300		
1900	55,540		23,700
1901	56,464	924	
1902	45,632		10,832
1904	86,302	40,670	
1905	45,429		40,873
1906	34,690		10,739
1907	44,350	9,660	
1908	41,101		3,249

July 1, 1908, balance unexpended	$6,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	8,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,426.15
July 1, 1909, balance unexpended	3,573.85
July 1, 1909, outstanding liabilities	505.54
July 1, 1909, balance available	3,068.31
July 1, 1909, amount covered by uncompleted contracts	846.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]

(*d*) *Amite River and Bayou Manchac, Louisiana.*—Prior to improvement the Amite River was navigable for small steamers for a distance of 45 miles from its mouth and Bayou Manchac for a distance of 10 miles, but both streams were obstructed by snags, logs, and overhanging trees.

The original project, as adopted in 1880 and modified in 1883 and 1888, provided for the removal of obstructions in Bayou Manchac from Hope Villa to the Amite River and in the latter stream to Lake Maurepas (its mouth), at an estimated cost of $31,760.

Amite River was improved for a distance of 42 miles from its mouth and Bayou Manchac for a distance of 10 miles from its junction with the former stream. A turning basin was made at the upper limit of improvement in Bayou Manchac.

The work of maintenance has been carried out under the project of 1892 and subsequent projects.

The improvement is not considered permanent, as snags and logs will continue to accumulate and bars will continue to form at the mouths of the streams, thus obstructing navigation.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of the boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation. On June 30, 1909, this boat was three-fourths completed.

---

[a] See consolidated money statement on page 460.

The amount expended to June 30, 1909, is $46,924.22, of which it is estimated $22,023.50 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, construction, and inspection of boat.

On June 30, 1909, the maximum draft that could be carried at mean low water over the bar in Lake Maurepas at the mouth of the river was 6 feet. The usual tidal variation at mouth of river is 6 inches; the level of water surface in Bayou Manchac varies as much as 6 feet. Amite River is navigable in fact to the mouth of Bayou Manchac, a distance of 42 miles, and Bayou Manchac is navigable to Hope Villa, a distance of 10 miles.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the state railroad commission that Hope Villa, on Bayou Manchac, has been granted a special tariff, with rates lower than normal ones.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations and maintenance of improvement.

On page 398, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of these streams.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	60,305	5,556	
Calendar year—			
1899	59,850		
1900	25,400		34,450
1901	69,918	44,518	
1902	44,694		25,224
1904	120,851	76,157	
1905	43,371		77,480
1906	50,669	7,298	
1907	45,552		5,117
1908	43,558		1,994

July 1, 1908, balance unexpended	$20,211.33
Amount allotted from appropriation by river and harbor act approved March 3, 1909	1,000.00
	21,211.33
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,641.54
July 1, 1909, balance unexpended	16,569.79
July 1, 1909, outstanding liabilities	505.54
July 1, 1909, balance available	16,064.25

July 1, 1909, amount covered by uncompleted contracts	$3,430.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a]

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

CONSOLIDATED.

July 1, 1908, balance unexpended	34,475.35
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	39,475.35
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	13,495.78
July 1, 1909, balance unexpended	25,979.57
July 1, 1909, outstanding liabilities	1,516.62
July 1, 1909, balance available	24,462.95
July 1, 1909, amount covered by uncompleted contracts	5,123.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix S 8.)

9. *Channel, bay, and passes of Bayou Vermilion, and Mermentau River and tributaries, Louisiana*—(a) *Channel, bay, and passes of Bayou Vermilion.*—Prior to improvement the upper 12 miles of Bayou Vermilion was only 2 feet deep, and its lower portion, through the bay and passes, not less than 5½ feet deep, and had a width varying from 100 to 400 feet. The channel, however, was obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1880, provided for the removal of snags and for dredging at an estimated cost of $9,900. A modified project, adopted in 1892, provided for securing a navigable depth of 5½ feet up to the railroad bridge near Lafayette, La., and for the erection of guide piling to mark the channel from the mouth of the bayou to Vermilion Bay, a distance of about 5 miles, at an estimated cost of $25,000. Project for maintenance was adopted in 1905.

The improvement is not considered permanent, as obstructions will continue to form and must be periodically removed.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of said boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation. On June 30, 1909, the boat was three-fourths completed.

Operations were carried on by the steamer *Hyacinth* between June 11 and 18, 1908, for the removal of snags and other obstructions below Abbeville, La.

The amount expended to June 30, 1909, is $40,784.16, of which amount $30,884.16 has been expended for maintenance. The expenditures during the past fiscal year were for collection of commercial statistics and construction and inspection of boat.

---

[a] See consolidated money statement on this page.

On June 30, 1909, the maximum draft that could be carried over the bar at mouth of Bayou Vermilion was about 3 feet and in the upper part of the stream 2½ feet. The usual tidal variations at mouth of bayou is about 1 foot and in upper part about 18 inches. The bayou is navigable to D. O. Broussard's landing, about 20 miles above Abbeville, La., or 46 miles from mouth, although it is obstructed by snags and logs.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the state railroad commission that at Abbeville there are lower rates than to intermediate points, on account of its being located on navigable water.

The amount estimated for expenditure in the fical year ending June 30, 1911, is intended for dredging and snagging operations.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	14,969	6,107	
Calendar year—			
1900	21,150	6,181	
1901	31,385	10,235	
1902	37,000	5,615	
1903	15,157		21,843
1904	29,326	14,169	
1905	28,092		1,234
1906	32,025	3,933	
1907	37,515	5,490	
1908	26,589		10,926

On page 399, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of this stream.

Reports on preliminary examination and survey to Lafayette with a view to obtaining 6 feet of water, required by act of March 2, 1907, were submitted on January 21 and August 10, 1908, and are printed in House Document No. 1218, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$7,029.56
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,500.00
	9,529.56
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,713.72
July 1, 1909, balance unexpended	4,815.84
July 1, 1909, outstanding liabilities	486.93
July 1, 1909, balance available	4,328.91
July 1, 1909, amount covered by uncompleted contracts	817.50
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]

---

[a] See consolidated money statement on page 463.

(*b*) *Mermentau River and tributaries, Louisiana.*—Prior to improvement these streams had depths varying from 7 to 30 feet. The channel through Grand Lake was 6 feet deep, and the depth at the mouth of the river was about 13 feet. The width varies from 70 feet, near Viterboville, to 350 feet at Lake Arthur. The channel was crooked and obstructed by snags and logs.

The original project of 1892 provided for the removal of obstructions in the upper river and the construction of brush dams in the lower river to remove existing mud flats. The estimated cost was $23,615.25.

With the appropriations of 1892, 1894, and 1896 operations were carried on from December, 1892, to December, 1899, and 38 miles of the channel, from the lower end of Lake Arthur downstream, was cleared of obstructions; two brush dams, 2,500 and 3,000 feet in length, respectively, were built in Mud Lake, and a channel 8 feet in depth and 50 feet in width was cut across the flats in Mud Lake and maintained as the exigencies of navigation required.

An examination made in July, 1906, showed that Bayou Nezpique, the principal tributary, was obstructed with snags and logs and that dredging would probably be required for maintenance of the channel through Grand Lake and Lower Mud Lake. Operations were commenced in Bayou Nezpique with a hired plant on August 21, 1906, and were completed on October 6, 1906. All obstructing snags and logs were removed from the channel for a distance of 21 miles below Viterboville, La.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of this boat for the removal of such bars, snags, logs, and overhanging trees as interfere with navigation. On June 30, 1909, this boat was three-fourths completed.

The amount expended to June 30, 1909, is $32,504.13, of which it is estimated that $15,787.65 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, construction and inspection of boat.

On June 30, 1909, the maximum draft that could be carried over the flats in Lower Mud Lake, the shoalest place in the channel, was 4 feet at mean low water. The usual variation of the level of water surface in the lower reaches of the river is about 1½ feet, and the extreme variation is about 2½ feet. Mermentau River is navigable throughout its whole length to about 2 miles above Mermentau, a distance of about 70 miles; Bayou Nezpique, the principal tributary, is navigable to Viterboville, La., a distance of about 25 miles above the head of the Mermentau River; Bayou Plaquemine Brule and Bayou des Cannes are each navigable for distances of about 10 miles, and Bayou Queue de Tortue for about 12 miles.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the state railroad commission that at Mermentau there are lower rates than at intermediate points, on account of its being located on navigable water.

The amount estimated for expenditure in the fiscal year ending June 30, 1911, is intended for dredging and snagging operations.

Comparative statement of shipments and receipts for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	22,236	3,586	
Calendar year—			
1900	27,034		
1901	29,291	2,257	
1902	50,326	21,035	
1903	63,690	13,364	
1904	45,866		17,824
1905	42,413		3,453
1906	61,634	19,221	
1907	49,756		11,878
1908	44,382		5,374

On page 401, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of this stream.

Reports of examination with plan and estimate of cost of improvement of Bayou Plaquemine Brule, required by act of March 2, 1907, were submitted December 19, 1907, and February 8, 1908, and are printed in House Document No. 789, Sixtieth Congress, first session.

The act of March 3, 1909, calls for a preliminary examination of Bayou Queue de Tortue, report on which will be submitted for transmission to Congress at its next session.

July 1, 1908, balance unexpended	$18,068.53
Amount allotted from appropriation by river and harbor act approved March 3, 1909	1,500.00
	19,568.53
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,657.41
July 1, 1909, balance unexpended	14,911.12
July 1, 1909, outstanding liabilities	486.93
July 1, 1909, balance available	14,424.19
July 1, 1909, amount covered by uncompleted contracts	3,500.84
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(*a*)

CONSOLIDATED.

July 1, 1908, balance unexpended	$25,098.09
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	29,098.09
June 30, 1909, amount expended during fiscal year. for maintenance of improvement	9,371.13
July 1, 1909, balance unexpended	19,726.96
July 1, 1909, outstanding liabilities	973.86
July 1, 1909, balance available	18,753.10

---

a See consolidated money statement on this page.

July 1, 1909, amount covered by uncompleted contracts	$4,318.34
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	6,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix S 9.)

10. Homochitto River, Mississippi.—The Homochitto enters the Mississippi River from the east about 25 miles below Natchez. For the first 3 miles from that point it is designated as the "Narrows" and for a distance of 12 miles farther as "Old River." A preliminary examination, made in 1896, showed that the Narrows had a depth of 5 feet at low water and a width of 150 feet, except for a distance of about 1 mile, where the stream is very narrow and shoal. This narrow and shoal portion was obstructed by snags and logs. Old River was about 1,000 feet wide and about 2 feet in depth over the shoalest places at low water. It was clear of obstructions. Above Old River the Homochitto River had a navigable depth of about 8 feet and a width of about 150 feet for a distance of about 45 miles, but it was thickly obstructed by snags, logs, and overhanging trees.

The act of March 3, 1899, appropriated $16,000 for the removal of obstructions between the mouth of the river and the Yazoo and Mississippi Valley Railway bridge, a distance of about 60 miles, and a project for the work was approved April 18, 1899.

Work under this project was commenced November 27, 1899, and continued until August 13, 1900, resulting in the improvement of the channel for a distance of about 18 miles and a width varying from 60 to 200 feet. Subsequent operations have been for maintenance. It is proposed to apply the available funds toward the construction of a combined dredge and snag boat. On June 30, 1909, this boat was three-fourths completed.

The amount expended to June 30, 1909, is $18,291.53, of which $2,809.86 was applied to the maintenance of the improvement. The expenditures during the past fiscal year were for construction and inspection of boat.

The Homochitto River is navigable, in fact, during periods of high water in the Mississippi River for a distance of about 18 miles, above which point it would be navigable for a farther distance of about 42 miles except that it is thickly obstructed with snags, logs, and overhanging trees. The maximum draft that could be carried June 30, 1909, over the bar at lower end of Old River, the shoalest part of the locality under improvement, was about 2½ feet at mean low water. The 5 miles of channel above Old River, which was cleared of obstructions in 1903, has again become badly obstructed by snags.

The usual variation in level of the water surface between high and low water is about 30 feet, the high-water period usually lasting about three and one-half months. No point on the river where the channel has been improved is reached by a railroad, and the project has therefore no effect on freight rates.

No detailed commercial statistics for the calendar year 1908 were available. Circular letters and blank forms for furnishing statistics were sent out, but no replies were received. The commerce consists mainly in the rafting of timber.

On page 393, Annual Report of the Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys.

Reference is invited to report on preliminary examination made in accordance with river and harbor act of March 2, 1907, printed in House Document No. 692, Sixtieth Congress, first session. For the reasons given therein, this river is considered not worthy of further improvement by the United States at the present time, and in compliance with section 7, river and harbor act of March 3, 1899, discontinuance of appropriations is recommended.

July 1, 1908, balance unexpended	$6,313.10
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	604.63
July 1, 1909, balance unexpended	5,708.47
July 1, 1909, outstanding liabilities	126.00
July 1, 1909, balance available	5,582.47
July 1, 1909, amount covered by uncompleted contracts	1,500.00

(See Appendix S 10.)

11. Bayou Lafourche, Louisiana.—Bayou Lafourche is an outlet of the Mississippi River, forming a junction with that stream 70 miles above New Orleans. It is about 105 miles long and flows into the Gulf of Mexico. In its original condition it was obstructed by logs, snags, and overhanging trees. The project of 1879 provided for the removal of such obstructions to improve low-water navigation. Work under this project was carried on until 1885, with appropriations aggregating $30,000.

The project of June 11, 1886, provided for the construction of a lock to connect the bayou with the Mississippi River and for dredging a channel 75 feet wide and 5 feet deep at mean low water of the Gulf, at an estimated cost of $450,000 and $8,000 annually thereafter for maintenance. Work under this project was confined to dredging to maintain low-water navigation, the appropriations at any one time being insufficient to warrant the commencement of the lock and the exigencies of commerce not permitting a suspension of the dredging.

The project of 1886 was modified on September 23, 1896, and held in abeyance the construction of the lock, restricting operations to dredging to maintain low-water navigation, at an estimated cost of $25,000 per annum.

Dredging operations have been in progress since 1896, but the improvement is not permanent, as sand bars form each year after the subsidence of floods in the Mississippi River.

The amount expended on this work up to June 30, 1909. was $258,085.17.

The navigation of Bayou Lafourche is at present obstructed by a dam placed across the head of the bayou at its junction with the Mississippi River by levee boards of the State of Louisiana, under authority of the act of Congress approved June 13, 1902. The time for the removal of this dam was extended to January 1, 1910, by the river and harbor act of March 2, 1907.

The depth of water in the bayou is practically the same as last year, which was at mean low tide 3½ feet at the mouth, the usual variation of the water surface being between one-half and 1 foot. The bayou is navigable its entire length by flatboats and log rafts, but, as stated above, connection between the bayou and the Mississippi River is at present cut off by a dam.

The commerce of this bayou is carried principally by small gasoline boats that ply between New Orleans and points along the bayou by way of Barataria Canal.

The effect of the project on freight rates is not definitely known.

It is proposed to expend the amount requested either in dredging, should the dam be removed, or in expenses of superintendence, inspection, etc., should the lock be built by the state levee boards, and in dredging.

Comparative statement of receipts and shipments for ten years.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	157,258		49,258
1900	210,315	53,057	
1901	137,357		72,958
1902	132,745		4,612
1903	94,351		38,394
1904	66,839		27,512
1905	94,320	27,481	
1906	59,092		35,228
1907	46,413		12,679
1908	64,914	18,501	

July 1, 1908, balance unexpended	$1,914.83
June 30, 1909, amount carried to the surplus fund	1,914.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix S 11.)

12. Removing the water hyacinth from waters in Louisiana and Texas.—Under the provisions of the sundry civil act of June 4, 1897, a Board of Engineer officers, appointed to investigate the extent of obstruction to navigation in the streams of Florida and Louisiana and to determine a method of checking the growth of or removing the water hyacinth, recommended the construction of boats fitted with crushing machinery and the use of log booms as adjuncts to the boats. (See Annual Report of the Chief of Engineers for 1899, p. 1615.)

Under the act of March 3, 1899, $25,000 was appropriated for the purchase of a boat, $1,000 for the construction of log booms, and $10,000 for operating expenses.

A boat purchased and fitted with machinery for crushing the hyacinths was operated in Bayou Plaquemine and contiguous streams from July, 1900, to June, 1901, when funds were exhausted. Approximately 188,800 square yards of plants was removed.

A boom, with a suitable gate to permit of the plants floating out with the tides and to prevent their return, was constructed and placed at the mouth of Bayou Teche, Louisiana.

Act of June 13, 1902, permitted the destruction of the plants by chemical means or otherwise, and the boat was fitted with special machinery designed for spraying the plants with a chemical compound. Operations were carried on in this manner from September, 1902, to May, 1903, and from August to October, 1903. Approximately 522,750 gallons of the compound was sprayed over an area estimated at 3,509,024 square yards of hyacinths.

Bayou Plaquemine and contiguous streams were, at date of cessation of operations (October 26, 1903), practically free from hyacinths.

The steamboat *Ramos* began spraying operations July 8, 1904. When the season's operations were terminated, the following streams were effectively cleared of all obstructing hyacinths: Bayou Plaquemine, Grand River, Bay Natchez, Bayou Goddell, Belle River, Bayou Long, Bayou Grossetete, and Bayou Choctaw. Booms for controlling the hyacinths were placed in Bayou Plaquemine, at mouth of Bay Grossetete, at the head of navigation in Bayou Grossetete, and across Bayou Choctaw. During the summer months a watchman is maintained at the Bayou Plaquemine boom, whose duty it is to require all rafts and boats to clear themselves of hyacinths before passing through.

The act of March 3, 1905, appropriated $40,000 for the removal of the water hyacinths from the navigable waters of the State of Texas and Louisiana, and projects, approved April 28 and May 15, 1905, provided for continuance of spraying operations in the Plaquemine-Morgan City water route and for the outfitting of a second boat for operations in the Calcasieu River, Louisiana, and in the Sabine and Neches rivers, Texas.

Operations were resumed in Bayou Plaquemine April 8, 1905, and were continued until October 31 in this and connecting streams named above, at which date the condition of the streams between Plaquemine and Morgan City was sufficiently satisfactory to warrant the suspension of further spraying operations for the season. During the entire season a new chemical compound was used, which gave excellent results at greatly diminished cost. In the season's work a total of 227,292 gallons of chemical compound was used, at a cost for chemicals of $1,098.66. At the price paid in previous seasons for chemical compound this quantity would have cost $6,818.76. There was therefore a saving of over $5,700, which will pay the operating expenses of the *Ramos* and of the hyacinth booms for a season. It is estimated that each gallon of chemical destroyed approximately 10 to 12 square yards of hyacinths.

The steamboat *Hyacinth* (except the hull, which was purchased) was built and equipped by hired labor at the engineer depot at New Orleans at a total cost of $8,900.

During the fiscal year 1907 spraying operations were carried on in the streams of the Plaquemine-Morgan City route, resulting in clearing the streams of all obstructing hyacinths. Cow Bayou, a tributary of the Sabine River, Texas, and Bayou des Allemands and contiguous streams, which were completely blocked by hyacinths, were cleared.

In October, November, and December, 1906, the *Ramos* sprayed in Calcasieu River, in English Bayou, a tributary of the Calcasieu, and in Bayou Vermilion, but the season was too far advanced for good results.

During the working season of 1906 265,409 gallons of chemical compound was sprayed, at a cost of $0.0051 per gallon raw. During the fiscal year ending June 30, 1908, operations were carried on in Bayou des Allemands, Bayou Barataria, Bayou Vermilion, and in the streams of the Plaquemine-Morgan City route.

During the working season of 1907 507,622 gallons of chemical compound were sprayed, at a cost of $0.0055 per gallon raw, and in 1908, to June 30, 124,236 gallons, at a cost of $0.0041 per gallon raw.

During the fiscal year ending June 30, 1909, the *Hyacinth* worked in Bayou Vermilion, Little Bayou, Bayous Blue, Des Allemands, Boeuf, Grand, Barataria and Teche, destroying and removing hyacinths from these streams.

In addition to the usual watchman at the Plaquemine Bayou, one was also hired to operate a temporary boom in Bayou des Allemands.

During the working season of 1908, 281,956 gallons of chemical compound were used at a cost, raw, of $0.0040 per gallon.

During the season of 1909, 17,291 gallons have been used at a cost, raw, of $0.0034 per gallon.

The steamboat *Hyacinth* underwent extensive alteration and repairs from November 19, 1908, to May 24, 1909.

The amount expended to June 30, 1909, was $122,746.34.

The amount estimated for expenditures in the fiscal year ending June 30, 1911, is intended for operating boats for spraying plants and the installation of booms and hire of watchmen for their operation and maintenance.

July 1, 1908, balance unexpended	[a]$9,627.21
February 24, 1909, amount allotted from appropriation for emergencies in river and harbor works, act of March 2, 1907	5,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
Miscellaneous receipts from sales of property, etc., deposited to the credit of appropriation	138.00
	34,765.21
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	[b]11,782.56
July 1, 1909, balance unexpended	[c]22,982.65
July 1, 1909, outstanding liabilities	692.06
July 1, 1909, balance available	22,290.59
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S 12.)

---

[a] Balance unexpended as shown by Annual Report for 1908 was $10,127.21. This was an error due to the fact that no deduction was made in said report to cover the sum of $500, which was allotted on November 4, 1907, by the Chief of Engineers to the Galveston, Tex., district for Buffalo Bayou. The corrected balance on July 1, 1908, was $9,627.21.

[b] Amount expended from appropriation for removing water hyacinths, etc.	$9,765.21
Amount expended from appropriation for emergencies, etc	2,017.35
	11,782.56

[c] Balance unexpended, appropriation for emergencies, etc	2,982.65
Balance unexpended, appropriation for removing the water hyacinths in Louisiana and Texas	20,000.00
	22,982.65

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination, with plan and estimate of cost of improvement, of Bayou Terrebonne, Louisiana, with a view to obtaining 6 feet of water.*—Reports dated July 13, 1907, and November 29, 1907, respectively, are printed in House Document No. 1163, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $50,000 is presented, provided any land needed for extra width of channel or depositing dredged material shall be first deeded to the United States free of cost.

2. *Preliminary examination and survey of Bayou Vermilion, Louisiana, to Lafayette, with a view to obtaining 6 feet of water.*—Reports dated January 21, 1908, and August 10, 1908, respectively, are printed in House Document No. 1218, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $22,660 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE GALVESTON, TEXAS, DISTRICT.

This district was in the charge of Capt. John C. Oakes, Corps of Engineers. Division engineers, Col. E. H. Ruffner, Corps of Engineers, to August 31, 1908, and Lieut. Col. Lansing H. Beach, Corps of Engineers, since that date.

1. *Galveston Harbor, Texas.*—Galveston Harbor originally embraced an anchorage area of over 1,960 acres, of which 1,500 acres had a depth of more than 20 feet, 1,300 acres had a depth of more than 24 feet, and 460 acres had a depth of more than 30 feet.

The entrance was obstructed by two bars, known as the inner and outer. The natural depth on the inner bar was about 9 feet and on the outer bar about 12 feet. These shallow depths prevented all but the lightest-draft vessels from using the harbor and necessitated the lighterage of cargoes to the larger vessels anchored in the deep water beyond the outer bar.

Prior to 1874 the projects for improving the harbor related to dredging operations on a small scale.

The project for the permanent improvement by jetties was adopted in 1874 and modified in 1880 and 1886. Previous to 1886, $1,478,000 was expended, with an additional sum of $100,000 subscribed by the city of Galveston in 1883.

The 1886 project provided for a certain depth of 25 feet and a possible depth of 30 feet by constructing jetties to a height of 5 feet above mean low tide and extending them to the 30-foot contour in the Gulf and supplementing the action of the tidal scour by dredging. The estimated cost of this revised project was $7,000,000.

The expenditures under the above projects resulted in 1900 in a depth of 26 feet at mean low tide on the outer bar, an increase of 14 feet since work began, and a depth of 26 feet at mean low tide on the inner bar, an increase of 16 feet during the same period.

The south jetty extended 35,603 feet and the north jetty extended 25,907 feet. The amount expended on this project was $7,041,684.42, of which $97,687.85 was for maintenance of the improvement.

The hurricane of September 8, 1900, damaged the jetties to a considerable extent, and a Board of Engineer officers estimated the cost of repairing the same at $1,500,000. (Annual Report Chief of Engineers, 1901, p. 2018.) Appropriations under this estimate commenced June 13, 1902.

The act of March 2, 1907, appropriated $300,000 and authorized continuing contracts for prosecuting the work to the amount of $700,000 additional, all of which has since been appropriated. In pursuance of the discretion vested in him by this act, the Secretary of War approved a project for expenditure of the funds appropriated and pledged in obtaining a depth of 30 feet by repairing the jetties, by jetty extension, and by dredging, including construction of a new dredge.

For more extended information see House Document No. 340, Fifty-ninth Congress, second session, and River and Harbor Committee Document No. 11, Fifty-ninth Congress, second session.

The new dredge *Galveston* commenced work November 24, 1908, and the jetty extension and repairs of the jetties have continued during the year and are about 92 per cent completed. Maintenance by dredging has been carried on by the U. S. dredges *Galveston* and *Comstock*.

From June 13, 1902, to June 30, 1909, $2,102,512.12 have been expended in accordance with modified project, including $507,901.26 for dredging, $372,256.10 for construction of new dredge *Galveston*, and $3,443.72 for survey authorized by act of May 27, 1908.

The old wharf of the state quarantine department of Texas, located in Galveston Bay, which had been abandoned and was in a wrecked condition, also the load of stone of an old jetty barge near the channel south of Fort Point, were removed.

The project depth of 30 feet has been completed.

The sundry civil act of May 27, 1908, provided for a survey of Galveston Harbor as a whole for a comprehensive plan for further improvement. Report was made in December, 1908.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, for maintenance by the operation of the dredges.

The outer-bar channel, where dredging is done, weather permitting, had at the beginning of the fiscal year 27½ feet at mean low tide. The last survey in June, 1909, shows a channel depth of 30¼ feet, an increase of 2¾ feet during the past year. With the exception of one stretch of less than 1,000 feet, there is a fine navigable channel of 32½ feet from within the inner bar across the outer bar to deep water.

The inner bar has disappeared, leaving a ruling depth of 36 feet at mean low tide. This result has been accomplished by the Galveston channel current, aided by the *Comstock*, which worked on the inner bar when it was too rough for it to work outside.

Mean tide fluctuations on outer bar, 2 feet; inner bar, 1.64 feet; Galveston channel, 1.12 feet. Including Galveston channel, 1,738 acres now have a depth of 24 feet and over, and 888 acres have a depth of 30 feet and over.

All the commerce for Galveston channel, Texas City channel, Port Bolivar channel, Galveston ship channel, and Buffalo Bayou, which comes in from the Gulf or passes out to the Gulf, whether coastwise or foreign, passes through the jetty channel.

A board of engineer officers in its report of December 19, 1902, stated that a conservative estimate of the value to the country of the present improvement at Galveston is more than $10,000,000 per annum. This benefit is probably, at the present time, more than double that amount annually.

A map of the last survey of the outer bar is submitted herewith.

July 1, 1908, balance unexpended		[a] $720,345.16
Amount allotted from appropriation by river and harbor act approved March 3, 1909		200,000.00
Amount appropriated by sundry civil act approved March 4, 1909		70,000.00
Proceeds of sales of charts of Galveston Bay		28.00
Proceeds of sales of contact prints		[b] 1.04
Proceeds of sales of old boilers of dredge *Comstock*		1,200.00
Proceeds of sales of condemned property		156.58
		991,730.78
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$314,065.24	
For construction of dredge	[c] 306,033.51	
For maintenance of improvements	101,675.77	
		721,774.52
July 1, 1909, balance unexpended		[d] 269,956.26
July 1, 1909, outstanding liabilities		[e] 59,321.33
July 1, 1909, balance available		210,634.93
July 1, 1909, amount covered by uncompleted contracts		[f] 52,003.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvements, in addition to the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[g] 250,000.00

(See Appendix T 1.)

2. *Galveston channel, Texas.*—This is the channel passing along the wharf front of the city and connecting the same with the jettied entrance channel.

Galveston channel inside the inner bar had originally a depth varying from 20 feet at Fort Point to 30 feet off Twentieth street, and again to 20 feet off Thirty-second street. The width of the channel between the 18-foot contours was about 600 feet. The inner bar had originally a 9-foot depth, but conditions gradually became better until the outer bar, with about 12-foot depth, became the controlling factor.

---

[a] The unexpended balance, as given in the Annual Report of the Chief of Engineers for 1908, should have included $67,750 in hands of Major Deakyne for dredge construction.

[b] Includes 54 cents received by Major Deakyne for blueprint of dredge.

[c] Amount expended by Major Deakyne for construction of dredge.

[d] Includes $5,453.90 in hands of Major Deakyne.

[e] Includes $4,750 for construction of dredge.

[f] Includes $4,516 for construction of dredge.

[g] Since the preparation of this report and estimate the Galveston jetties have been damaged by the storm of July 21, 1909. The local officer estimates that the additional sum of $100,000 will be required to make the necessary repairs.

All vessels drawing over 12 feet had to complete their cargoes by lightering after crossing the bar.

Appropriations by the United States Government for the channel began in 1902, when $100,000 was appropriated for improving the channel in accordance with the report submitted in House Document No. 264, Fifty-sixth Congress, second session. The act of March 3, 1905, authorized the construction of a dredge, *Col. A. M. Miller*, at a cost not to exceed $125,000.

The act of March 2, 1907, modified the project by providing for the extension of the channel from Fifty-first street to Fifty-sixth street, at an estimated cost of $129,310. (See H. Doc. No. 768, 59th Cong., 2d sess.) The adopted project therefore contemplates the excavation of a channel 30 feet deep and 1,200 feet wide from the inner bar to Fifty-first street and the extension of said channel 700 feet wide from Fifty-first street to Fifty-sixth street.

The estimated cost of the project as modified is $1,714,310.

The U. S. dredge *Col. A. M. Miller* moved during the fiscal year 858,587 cubic yards of material in widening and maintaining the channel, of which 700,330 cubic yards was new work and 158,257 cubic yards was maintenance.

The project is 58 per cent completed, giving a channel approximately 1,325 feet wide opposite the proposed immigrant landing station just within the inner bar, 900 feet wide and 25 to 33 feet deep to a point opposite Twenty-ninth street, and 750 feet wide and 25 to 35 feet deep to the end of the present wharf frontage.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, for dredging and dike construction was $719,576.19, of which $55,827.84 was for maintenance of the improvement.

Vessels drawing 28½ feet can now come to the wharves at mean low tide.

The *Monomoy* left this port August 31, 1908, drawing 28 feet and 2 inches, the *Irada* on October 9, 1908, drawing 28 feet, and the *Rowanmore* on November 21, 1908, drawing 28 feet and 6 inches.

Variation of level of water surface is about 1 foot.

The foreign trade, as given by the customs office, for the port of Galveston for the calendar year 1908 amounted as follows: Foreign exports, valued at $202,152,984; foreign imports, valued at $5,516,822; total, $207,669,806.

Partial statistics for coastwise trade were furnished by the secretary of the Galveston Chamber of Commerce and other interested parties as 900,497 tons, valued at $218,388,000.

The following is a comparison of foreign export values credited to ports in the United States on the Gulf of Mexico in the government records for a period of six years:[a]

Fiscal year.	Galveston.	New Orleans.	Mobile.	Pensacola.
1902-3	$103,145,623	$147,056,230	$12,618,443	$13,744,544
1903-4	144,920,127	148,006,606	16,826,671	15,891,834
1904-5	126,085,590	149,866,358	18,071,982	15,340,265
1905-6	166,240,813	149,901,013	21,712,544	18,440,122
1906-7	236,277,727	169,897,311	24,463,696	19,218,433
1907-8	161,020,933	159,357,584	27,979,831	20,332,649

---

[a] Data furnished by Judge A. J. Rosenthal, special deputy collector, United States customs service.

The value of foreign exports credited to the port of Galveston for the fiscal year 1896–97 amounted to $59,334,343, and for the fiscal year 1906–7 to $236,277,727, or about four times the amount for 1896–97. The gain from 1902–3 to the end of 1906–7 amounted to 129 per cent. During the year 1907–8 there was a decrease in value of commerce handled through this port, amounting to $34,124,743.

A sufficient depth and width of channel is a necessary supplement to the deep water between the jetties to enable the vessels to reach the wharves. The work of the past year has put the channel in better condition for service than ever before, but with the increasing length of the vessels now entering the harbor the necessity for the full width of channel between harbor lines (1,400 feet) is becoming very marked.

It is proposed to apply the balance available on June 30, 1909, to the extension of channel and dike to opposite Fifty-sixth street, and the additional appropriation recommended in operation of the United States dredge for widening the present channel and for maintenance.

July 1, 1908, balance unexpended		$60,543.89
Amount allotted from appropriation by river and harbor act approved March 3, 1909		200,000.00
Proceeds of sales of contact prints		.60
Proceeds of sales of condemned property		179.17
		260,723.66
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$27,743.42	
For maintenance of improvement	7,202.09	
		34,945.51
July 1, 1909, balance unexpended		225,778.15
July 1, 1909, outstanding liabilities		5,009.75
July 1, 1909, balance available		220,768.40
Amount (estimated) required for completion of existing project		825,137.84
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909		200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix T 2.)

3. *Channel from Galveston Harbor to Texas City, Tex.*—The natural depth over the line of this channel was from 4 to 8 feet. During 1895 and 1896 a channel 16 feet deep was dredged by the Texas City Terminal Company at an expense of $146,000. At the time of the adoption of the present project this channel had shoaled to its natural depth.

The river and harbor act of March 3, 1899, provided for deepening the channel north of Pelican Island from Galveston Harbor to Texas City, Tex., to a depth of 25 feet and a width of 100 feet at the bottom at a cost not to exceed $250,000.

The full amount had been expended on the work under this appropriation up to the close of the fiscal year ending June 30, 1905, the Texas City Company paying the expenses of superintendence, inspection, etc. The channel was dredged 100 feet wide on the bottom and 25 feet deep from Texas City wharves to 25 feet of water in Galveston Harbor, a distance of 34,000 feet.

In addition to the amounts mentioned above, the Texas City Company, according to figures furnished by them, expended $148,906.98 in completing channel, $172,734.58 in digging turning basin and slip, and in 1906 removed 698,222 cubic yards at a cost of $16,028.61 in maintaining channel.

This channel was redredged by contract completed September 19, 1907, for a distance of 17,590 feet from the wharf at Texas City, 1,001,147 cubic yards being removed.

During the past fiscal year 273,284 cubic yards of material have been removed by United States dredges in maintaining the channel.

The total amount expended by the United States to June 30, 1909, is $285,960.34, of which $35,960.34 was expended in maintaining the channel.

The amount of fill since project was completed to end of last fiscal year was 1,337,700 cubic yards, and the fill from June 18, 1907, to May 17, 1909, amounted to 1,371,500 cubic yards, making total fill to date of 2,709,200 cubic yards.

Variation of water surface is about 1¼ feet.

The ruling depth on May 17, 1909, was 12 feet, but owing to the softness of the silt, ships drawing 17 feet can pass through the channel.

The effect of the project on freight rates has been very beneficial during the past year owing to the establishment of a new line of steamers from New York to Texas City, thereby breaking up the rate agreement that had existed between the old lines between New York and Galveston.

The tonnage for the port of Texas City, Tex., for the calendar year 1908, as furnished by the Texas City Terminal Company, of Texas City, is as follows: Foreign exports and imports, 59,072 tons, valued at $3,403,960; coastwise domestic, 96,927 tons, valued at $18,201,566; total 155,999 tons, valued at $21,605,526.

It is proposed to expend the available balance and the additional appropriation recommended in maintaining the present channel.

July 1, 1908, balance unexpended	$34,480.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909	50,000.00
Proceeds of sales of contact prints	.40
	84,480.91
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	10,440.65
July 1, 1909, balance unexpended	74,040.26
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, in addition to the balance unexpended July 1, 1909	50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix T 3.)

4. *Channel to Port Bolivar, Tex.*—The river and harbor act of March 2, 1907, appropriated $50,000 for obtaining a channel 150 feet wide and 25 feet deep, with increased width at wharf, from Galveston Harbor to Port Bolivar.

This channel extends from the Gulf and Interstate Railway transfer wharf southerly to Bolivar Roads, a distance of 4,275 feet.

During the fiscal year 269,929 cubic yards of material was removed by contract, making a total of 517,927 cubic yards of material removed from this channel. The remains of a sunken dredge boat near Bolivar Point was removed. A slip and wharf were constructed by the Gulf and Interstate Railway Company of Texas, and the port was opened for commerce June 14, 1909.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of this channel is 19 feet.

Variation of water surface is about 1¼ feet.

The channel is used for tugs and barges in the transfer of freight cars to and from Galveston, and facilities are now available for ships to load and discharge at the Bolivar wharf.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $48,710.75.

The project is completed.

Commercial statistics received from the Gulf and Interstate Railway Company of Texas show the commerce passing through Bolivar channel to be more than 50,000 tons, valued at $5,578,705.

No marked effect on rates have been noted due to this work.

The available balance and the appropriation recommended will be expended for maintaining the channel and widening the turning basin in front of the wharves.

July 1, 1908, balance unexpended	$31,126.49
Amount allotted from appropriation by river and harbor act approved March 3, 1909	50,000.00
	81,126.49
June 30, 1909, amount expended during fiscal year, for works of improvement	29,837.24
July 1, 1909, balance unexpended	51,289.25
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, in addition to the balance unexpended July 1, 1909	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix T 4.)

5. *Galveston ship channel and Buffalo Bayou, Texas.*—The ship channel in Galveston Bay and Buffalo Bayou are two links in the waterway connecting Houston with deep water in Galveston Bay, the other links being the San Jacinto River and the Morgan Canal.

In their natural state these two waterways had a depth of from 4 to 8½ feet, of various widths. The earlier projects for their improvement, adopted in 1871, 1877, 1881, and 1892, provided for a channel 100 feet wide and 12 feet deep. Dredging was carried on for a number of years, furnishing a channel sufficient for the character of vessels then navigating these channels.

In 1892 the Government purchased the Morgan Cut and Canal, 5.43 miles long, for $92,316.85.

The amount expended on original projects prior to operations under existing projects was as follows:

Ship channel in Galveston Bay (including the purchase of Morgan Cut and Canal, $92,316.85)	$800,328.16
Buffalo Bayou, Texas	210,137.64
Total	1,010,465.80

The existing project, adopted in 1899 (p. 1515, Annual Report Chief of Engineers, 1898), as modified in 1905 (p. 1495 et seq., Annual Report Chief of Engineers, 1905), is as follows:

For completing channel to head of Long reach, including turning basin 600 feet in diameter, 25 feet deep, side slopes 1 on 2, division 1 (bay), 1 on 3 in divisions 2 and 3 (river), least radius 2,500 feet, 150 feet on bottom in division 1 (bay), 100 feet on bottom in divisions 2 and 3 (river)	$3,170,000
26,000 feet of dike revetment	40,000
One hydraulic dredge	150,000
Engineering and contingencies (about 10 per cent)	340,000
Total	3,700,000
Amount available December 1, 1904	150,000
Balance required	3,550,000

The act of March 2, 1907, appropriated $200,000 and authorized continuing contracts for prosecuting the improvement in the sum of $200,000, all of which has been appropriated.

Of the $200,000 appropriated March 2, 1907, $50,000 was expended for the restoration of the channel from foot of Main street, Houston, to head of Long reach.

By contract and United States dredges 3,717,209 cubic yards of material have been removed from the different divisions during the past fiscal year, of which 2,725,496 cubic yards was for maintenance and 991,713 cubic yards for improvement. Snagging operations have been carried on in the upper stretches of the bayou.

During the fiscal year the channel in the open bay has filled in generally throughout its entire length to an amount of 1,812,000 cubic yards. The channel in the bayou has not filled appreciably during the fiscal year, due to absence of freshets. Since the beginning of 1905 a fill of 8,178,000 cubic yards has taken place.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1909, was $2,082,668.63, of which $228,852.10 was for maintenance.

The project is about 50 per cent completed.

The usual variation of level of water surface is, division 1 (bay division), lower bay, 1.3 feet; upper bay, 0.5 foot; and divisions 2 and 3 (river divisions), less than one-half foot. In times of flood rises of 12 or more feet occasionally occur in Buffalo Bayou.

The maximum draft that can be carried on June 30, 1909, at mean low tide is, from Bolivar channel to Red Fish, 10 feet; thence to Morgan Point, 14 feet; thence to head of Long reach, 16 feet; thence 8 feet to foot of Main street, Houston. The channel has been dredged throughout to a depth of 18½ feet, including the turning basin.

The effect of this project on freight rates is unknown and is indeterminate because of a railroad rate differential in favor of Houston, authorized by the railroad commission of the State of Texas.

The wharfmaster at Houston reports the tonnage carried on the bayou during the calendar year 1908 as 602,734, valued at $28,318,621. It is given in detail in Appendix T 5 of this report.

For number of vessels passing through Morgan Canal, see report on operating and care of Morgan Canal, Appendix T 7 of this report.

It is proposed to expend the available funds and the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, toward completing work now under way, including easing bends to 2,500 feet radius, maintenance toward a more uniform depth, repair of pile and brush dike in upper bay, and snagging operations throughout the bayou.

If progress is to be made toward the completion of the project depth, 25 feet, throughout this channel, more liberal appropriations must be made for the work, as the cost of maintenance is increasing yearly as increased depth is obtained.

July 1, 1908, balance unexpended		$260,398.15
Amount allotted from appropriation by river and harbor act approved March 3, 1909		100,000.00
Amount appropriated by sundry civil act approved March 4, 1909		55,000.00
Proceeds of sales of contact prints		8.50
Proceeds of sales of condemned property		289.98
		415,696.63
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$154,185.52	
For maintenance of improvement	76,567.45	
		230,752.97
July 1, 1909, balance unexpended		184,943.66
July 1, 1909, outstanding liabilities		23,434.04
July 1, 1909, balance available		161,509.62
July 1, 1909, amount covered by uncompleted contracts		17,707.61
Amount (estimated) required for completion of existing project		2,800,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909		300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of river and harbor act of 1899.		

(See Appendix T 5.)

6. *Removing the water hyacinths from Texas waters.*—On August 9, 1907, water hyacinths were discovered in Buffalo Bayou, Texas, and vicinity, and an allotment of $500 was made on November 4, 1907, to destroy them to prevent them from becoming an obstruction to navigation.

Under United States supervision, the city of Houston, Tex., removed practically all hyacinths from Buffalo Bayou by hired labor.

Total amount expended on this work up to the close of the fiscal year ending June 30, 1909, was $35.26.

July 1, 1908, balance unexpended	$474.73
June 30, 1909, amount expended during fiscal year, for works of improvement.	9.99
July 1, 1909, balance unexpended	464.74

(See Appendix T 6.)

7. *Operating and care of Morgan Canal, Texas.*—A custodian was stationed at the canal during the past fiscal year.

A statement contained in the report of the local engineer officer shows the items of expenditure, which amounted to $360, exclusive of liabilities outstanding, amounting to $30.

July 1, 1908, balance unexpended	$390.00
Amount allotted June 23, 1909	360.00
	750.00
June 30, 1909, amount expended during fiscal year, for works of improvement.	360.00
July 1, 1909, balance unexpended	390.00
July 1, 1909, outstanding liabilities	30.00
July 1, 1909, balance available	360.00

(See Appendix T 7.)

8. *West Galveston Bay channel, Texas, and mouths of adjacent streams, including Trinity River, Anahuac channel, Cedar Bayou, Chocolate Bayou, and Bastrop Bayou.*—This project embraced the improvement of the following localities: West Galveston Bay, the Galveston and Brazos Canal, Double Bayou, mouth of Trinity River, Anahuac channel, East Bay Bayou, Turtle Bayou, Clear Creek, Dickinson Bayou, Chocolate Bayou, Bastrop Bayou, Oyster Creek, and the mouths of adjacent streams. (Annual Report Chief of Engineers, 1900, p. 2438, et seq.)

Prior to March 3, 1899, the improvement of West Galveston Bay channel, mouth of Trinity River, and Cedar Bayou had been independent. At that date they were consolidated with the other works, except Anahauc channel, which was added by act of March 3, 1905, and Chocolate and Bastrop bayous, which were added by the act of March 2, 1907. The Brazos River, between Velasco and Richmond, which was included in the improvement for a time, is now covered by a separate appropriation and has been transferred to the Dallas district. The estimated cost of the modified project is $248,646.34.

The object of this improvement, in part, is to obtain and maintain a navigable channel depth of from 4 to 6 feet across the bars at the mouths of the streams and bayous from deep water in the bay to deep water in the bayous.

The improvement is intended to develop a light-draft inland navigation which will afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

As the West Galveston Bay channel and Galveston and Brazos River Canal have been included in the "Inland waterway on the coast of Texas," and appropriated for under that heading, allotments for these works under this appropriation have ceased.

About five-sixths of the project has been completed.

The effect of these improvements has been generally to decrease freight rates to all points reached by the channels improved.

It is proposed to apply the balance available and the appropriation recommended in dredging and snagging, for maintenance, and in opening up bayous emptying into the Galveston bays, in accordance with approved project.

More and larger boats, especially power boats with schooner hulls, have been built to utilize the improvement. Most of the points reached are settlements not on railroads, and the improvements are of great importance to their commercial life.

The amount expended on these improvements under present project to June 30, 1909, has been as follows:

Channel across Hanna reef	$697.08
Double Bayou	13,193.99
Anahuac channel	12,100.00
Mouth of Trinity River	8,636.18
Cedar Bayou	11,946.23
Clear Creek	10,497.16
Dickinson Bayou	12,105.45
Bastrop Bayou	9,920.22
Chocolate Bayou	6,542.04
Dredge *Gen. H. M. Robert*	67,992.51
Dredge *Capt. C. W. Howell*	15,000.00
Total	168,630.86

(*a*) *Channel across Hanna reef* (*East Bay Bayou*).—This is a channel across Hanna reef, connecting lower Galveston Bay, East Bay, and East Bay Bayou, and is on the direct line of the inland waterway project. The natural depth was 2 feet at mean low tide.

Amount expended on work of existing project up to the close of the fiscal year ending June 30, 1909, $679.08.

During the year 5,773 cubic yards of material was removed, making a channel 6 feet deep, 40 feet wide on the bottom, and 955 feet long. Maximum draft that can be carried June 30, 1909, is about 4 feet at mean low tide.

Variation of water surface, about 1 foot.

It is estimated that 500 tons of vegetables comes out of East Bay Bayou via Moodys and Ladys passes, and that about 250 tons of general merchandise returns. There is also some fish and oysters carried through these passes, but the present shallow channel prevents any extensive business being carried on.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$2,000.00
June 30, 1909, amount expended during fiscal year, for works of improvement	15.17
July 1, 1909, balance unexpended	1,984.83
July 1, 1909, outstanding liabilities	1,144.89
July 1, 1909, balance available	839.94
Amount (estimated) required for completion of existing project	([a])
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

(*b*) *Double Bayou.*—The navigation of this bayou was obstructed by a bar which prevented boats drawing over 2 feet of water entering the bayou.

The amount expended on work of existing project up to the close of the fiscal year ending June 30, 1909, $13,193.99, of which $6,240.79 was applied to maintenance, exclusive of $2,711.40 deposited by private parties.

---

[a] See consolidated money statement on page 486.

This expenditure resulted in the excavation and maintenance of a channel 6,450 feet long, 60 to 80 feet wide, and from 5 to 7 feet deep across the bar and into the bayou.

The maximum draft that can be carried June 30, 1909, at mean low water is 7 feet.

The variation of water surface is about one-half foot.

This bayou within a half mile of its mouth divides into east and west branches, the east branch being navigable for 12 miles and west branch for 8 miles from mouth, making a total of 19½ miles.

The commerce through this channel, as given by Burt H. Collins, for the calendar year 1908, amounted to more than 5,000 tons of produce, mainly rice and merchandise, valued at $269,000.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$5,000.00
Proceeds of sales of condemned property	89.46
	5,089.46
Transferred to Dickinson Bayou, Texas	89.46
	5,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,644.84
July 1, 1909, balance unexpended	2,355.16
July 1, 1909, outstanding liabilities	2,088.22
July 1, 1909, balance available	266.94
Amount (estimated) required for completion of existing project	([a])
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

(*c*) *Anahuac channel.*—The original depth of this channel was about 3 feet.

Amount expended on work of existing project up to the close of the fiscal year ending June 30, 1909, $12,100, of which $6,124.99 was for maintenance of channel.

The expenditure resulted in the excavation and maintenance of a channel 16,013 feet long, 80 feet wide, and 7 feet deep from 6 feet of water in Trinity Bay to 8 feet of water in Browns Pass.

Maximum draft that can be carried June 30, 1909, at mean low tide is 4½ feet.

Variation of water surface is about one-half foot.

This channel is used by United States mail boat, and as there is no railroad communication with the adjacent country, all produce and supplies pass through this channel. Rice is the principal agricultural product.

This channel is navigable for 3½ miles from the 6-foot contour in Galveston Bay to Anahuac.

Commercial statistics received show the commerce to be more than 15,000 tons, valued at $780,000.

---

[a] See consolidated money statement on page 486.

Amount alloted from appropriation by river and harbor act approved March 3, 1909	$4,000.00
July 1, 1909, balance unexpended	4,000.00
Amount (estimated) required for completion of existing project	([a])
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*d*) *Mouth of Trinity River.*—This river empties into Galveston Bay through several mouths or passes, opposite each of which a bar existed on which the depth of water did not exceed 3½ feet at mean low tide.

Under earlier projects, adopted June 18, 1875, and amended May 4, 1899, dredging and snagging were done, the west jetty at Middle Pass completed to a length of 7,359 feet, and a channel 100 feet wide by 5 feet deep secured at a cost of $75,900. The channel subsequently shoaled to a ruling depth of 3½ feet, and at present Browns Pass leading to the Anahuac channel is the one used and under improvement.

Amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, $8,636.18, of which $4,995.74 was applied to maintenance.

Under present project a channel 80 feet wide and 6 feet deep was dredged a distance of 5,700 feet and a log jam removed from the pass.

Maximum draft that can be carried June 30, 1909, at mean low water, 4½ feet.

Variation of water surface is about one-half foot.

During the calendar year 1908, lumber, rice, etc., valued at $599,430, passed through this channel in addition to miscellaneous supplies.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$1,000.00
July 1, 1909, balance unexpended	1,000.00
Amount (estimated) required for completion of existing project	([a])
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*e*) *Cedar Bayou.*—Cedar Bayou discharges into the northwest corner of Galveston upper bay at a point about 1½ miles below the mouth of the San Jacinto River, and distant 28½ miles from Galveston.

The original project for this improvement was adopted September 19, 1890, and consisted in deepening the channel over the bar by dredging, so as to afford a depth of 5 feet at mean low tide, and protecting the dredged channel by brush and stone walls or jetties. The amount previously expended on this project was $32,150.

After crossing the bar a least depth of 9 feet can be carried up the bayou for a distance of 17 miles.

---

[a] See consolidated money statement on page 486.

Under present project the jetties were repaired by filling the lowest places and gaps with riprap, and a channel 8 feet deep, 80 feet wide, 8,690 feet long was dredged from the 8-foot depth inside the bayou across Cloppers bar and connecting with the 8-foot depth in San Jacinto Bay.

During the fiscal year 9,375 cubic yards of material was removed in maintaining the channel.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $11,946.23, of which $5,009.08 was applied to maintenance.

Maximum draft that can be carried June 30, 1909, 6 feet. This stream is navigable to Needle Point, head of navigation, a distance of 20 miles from the mouth.

The rise and fall of tide is about one-half foot, except during freshets.

It has been impossible to obtain the commercial statistics of the effect of this improvement. One boatman reports taking out 24,000 tons brick, valued at $120,000, and 18,000 tons sand, valued at $18,000, during the calendar year 1908. Rice and other agricultural products, together with supplies for the adjacent community, are carried through this channel, there being no railroad facilities within convenient distance.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$5,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	60.71
July 1, 1909, balance unexpended	4,939.29
July 1, 1909, outstanding liabilities	1,063.62
July 1, 1909, balance available	3,875.67
Amount (estimated) required for completion of existing project	([a])
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

(*f*) *Clear Creek.*—Clear Creek empties into Galveston upper bay from the west. It was obstructed at its mouth by a narrow sand bar, on which the depth did not exceed 2 feet. For a distance of 2 miles above the mouth the ruling depth is 8 feet. It then broadens into a lake 3 miles long and 1½ miles wide, having, before improvement, an average depth of 1½ feet. Above the lake the prevailing depth is from 8 to 12 feet.

Private parties have at various times dredged through the bar at the mouth into Galveston Bay, and during 1907-8 the U. S. dredge *Captain C. W. Howell* dredged a channel 22,847 feet long, 40 feet wide, and from 4 to 6 feet deep. At present there is across this bar a channel about 40 feet wide with a least depth of 4 feet at mean low tide.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $10,497.16, of which $7 was applied to maintenance.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of the locality is 4 feet.

---

[a] See consolidated money statement on page 486.

This stream is navigable to Friendswood, at the head of navigation, a distance of 20 miles, except that same is obstructed 10 miles from its mouth by Galveston County road bridge and Galveston, Houston and Henderson Railway bridge and 14 miles from its mouth by Davis bridge. During the past year the bridges have been modified so as to provide a 24-foot opening.

Variation of water surface is three-fourths foot.

No commercial statistics have been obtained.

July 1, 1908, balance unexpended	$51.87
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	4,051.87
Transferred to Dickinson Bayou	51.87
	4,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	7.00
July 1, 1909, balance unexpended	3,993.00
July 1, 1909, outstanding liabilities	671.05
July 1, 1909, balance available	3,321.95
Amount (estimated) required for completion of existing project	(a)
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*g*) *Dickinson Bayou.*—Dickinson Bayou empties into Galveston lower bay about 20 miles northwest of the city of Galveston. Navigation was obstructed by a bar at its mouth with 2½ feet of water on its crest. After crossing the bar a depth of 10 feet can be carried up the bayou for 20 miles or more, and a depth of 6 feet for a distance of 25 miles from its mouth.

During the past year the U. S. dredge *Captain C. W. Howell* excavated a channel from 6 to 6½ feet deep and about 60 feet wide over a distance of 19,100 feet through the shoal water of the bay and to deep water in the bayou.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $12,105.45, of which $5,823.12 was applied to maintenance.

The maximum draft that can be carried June 30, 1909, at mean low tide over the bar is 5 feet.

This stream is navigable 10 miles from mouth to Galveston, Houston and Henderson Railway bridge for tugs and schooners. The same class of vessels could navigate to a point 25 miles from the mouth on removal of county and railway bridges.

Variation of water surface is 1 foot.

Partial information received shows the commerce passing through this channel to be more than 1,400 tons, valued at $28,600.

---

[a] See consolidated money statement on page 486.

July 1, 1908, balance unexpended	$717.67
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
Transferred from Double Bayou	89.46
Transferred from Chocolate Bayou	987.78
Transferred from Clear Creek	51.87
	5,846.78
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,823.12
July 1, 1909, balance unexpended	23.66
July 1, 1909, outstanding liabilities	4.95
July 1, 1909, balance available	18.71
Amount (estimated) required for completion of existing project	([a])
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*h*) *Bastrop Bayou.*—Bastrop Bayou empties into Bastrop Bay, which is part of west Galveston Bay. The mouth of the bayou is 5 miles northwest of San Luis Pass and had a long shallow approach with only 10 inches of water on the bar. For 2 miles above the bar the water is shallow, averaging about 2 feet. Above that point there is, in general, a depth of 10 feet, but this depth was reduced by three shoals of a total length of about 3 miles with a depth of 2 feet. The stream can be navigated for a distance of 20 miles from its mouth.

A channel 400 feet long, 35 to 40 feet wide, and 4 feet deep was cut through the shell reef at the entrance to Bastrop Bay by the U. S. dredge and snag boat *Gen. S. M. Mansfield* in 1906 at a cost of $269.42, this amount being subscribed by interested parties.

During 1907 the U. S. dredge *Captain C. W. Howell* cut a channel 18,765 feet long, 40 feet wide, and 4 to 5 feet deep up the bayou beyond three small shoals obstructing navigation.

Amount expended on work of existing project to close of fiscal year ending June 30, 1909, $9,920.22.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of the locality is 3 feet.

Variation of water surface, 1 foot.

No commercial statistics have been obtained.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$4,000.00
July 1, 1909, balance unexpended	4,000.00
July 1, 1909, outstanding liabilities	604.13
July 1, 1909, balance available	3,395.87
Amount (estimated) required for completion of existing project	([a])
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

---

[a] See consolidated money statement on page 486.

(*i*) *Chocolate Bayou.*—Chocolate Bayou empties into Chocolate Bay, an arm of West Galveston Bay, about 12 miles north of San Luis Pass. At its mouth there is a bar with 3 feet of water on its crest. Above this bar the depth varies from 7 to 15 feet for 50 miles from its mouth.

During the fiscal year the U. S. dredge *Captain C. W. Howell* removed 98,904 cubic yards of material, making a channel 5½ feet deep, 40 feet wide, and 21,000 feet long from 5 feet of water in West Galveston Bay through Chocolate Bay to 5 feet of water in Chocolate Bayou.

Amount expended on work of existing project to close of fiscal year ending June 30, 1909, $6,542.04, of which $29.82 was applied to maintenance.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of the locality is 5 feet.

Variation of water surface, 1 foot.

This channel is used regularly by light draft vessels a distance of 24 miles from its mouth to Liverpool. It is also navigable for 15 miles beyond Liverpool and navigation could be extended farther were it not for the overhanging timber along the banks.

No commercial statistics have been obtained.

July 1, 1908, balance unexpended		$7,168.95
Amount allotted from appropriation by river and harbor act approved March 3, 1909		4,000.00
		11,168.95
Transferred to Dickinson Bayou, Texas		987.78
		10,181.17
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$6,181.17	
For maintenance of improvement	29.82	
		6,210.99
July 1, 1909, balance unexpended		3,970.18
July 1, 1909, outstanding liabilities		422.43
July 1, 1909, balance available		3,547.75
Amount (estimated) required for completion of existing project		(a)
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

DREDGE CAPTAIN C. W. HOWELL.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$15,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	15,000.00

UNALLOTTED.

Amount unallotted from appropriation by river and harbor act approved March 3, 1909	$2,000.00
July 1, 1909, balance unexpended	2,000.00

---

[a] See consolidated money statement on page 486.

CONSOLIDATED.

July 1, 1909, balance unexpended		$7,950.28
Amount allotted from appropriation by river and harbor act approved March 3, 1909		50,000.00
Proceeds of sales of condemned property		89.46
		58,039.74
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$6,196.34	
For maintenance of improvement	23,565.49	
		29,761.83
July 1, 1909, balance unexpended		28,277.91
July 1, 1909, outstanding liabilities		5,999.29
July 1, 1909, balance available		22,278.62
Amount (estimated) required for completion of existing project		59,646.34
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		110,000.00

(*j*) *Channel in West Galveston Bay.*—See Inland waterway on the coast of Texas.

(*k*) *Galveston and Brazos River Canal.*—See Inland waterway on the coast of Texas.

(See Appendix T 8.)

9. *Inland waterway on the coast of Texas.*—The river and harbor act of March 2, 1907, appropriated $133,829, and authorized the Secretary of War to enter into contract for materials and work to the extent of $300,000, all of which has since been appropriated.

This project embraces the improvement of the following localities: West Galveston Bay and Brazos River Canal; channel from Aransas Pass to Pass Cavallo, including the Guadalupe River to Victoria; Turtle Cove channel from Aransas Pass to Corpus Christi, Tex.

The object of the improvement is to obtain and maintain a navigable channel depth of 5 feet in a canal along the coast of Texas, utilizing the lagoons lying between the islands and the mainland. The improvement will develop a light-draft inland navigation which will afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

More and larger boats with auxiliary gas engines have been built to utilize the improvement. Most of the points to be reached are settlements which railways can not afford to develop, but the improvements are of great importance to their commercial life.

The project is about 70 per cent completed.

No reduction of freight rates due to this improvement has been noticed.

Amount expended under this appropriation to June 30, 1909, has been as follows:

West Galveston Bay and Brazos River Canal	$124,383.29
Aransas Pass to Pass Cavallo	45,362.81
Guadalupe River	68,258.60
Turtle Cove channel	122,107.64
Total	360,112.34

It is proposed to apply the balance available and amount estimated as a profitable expenditure in dredging, snagging, etc., in accordance with approved project.

(*a*) *West Galveston Bay and Brazos River Canal.*—Previous to 1908 these channels were carried under another appropriation—viz, "West Galveston Bay channel, Texas, and mouths of adjacent streams, etc."

West Galveston Bay.—This is a body of water covering about 39 square miles and lies between Galveston Island and the mainland. It extends from Galveston Bay to the west end of Oyster Bay and is connected with the Gulf of Mexico by San Luis Pass at the western extremity of Galveston Island and with the Brazos River by the Galveston and Brazos Canal. The minimum depth of the bay was from 2½ to 3 feet.

The project adopted July 13, 1892, and modified in 1896, contemplated a least depth of 5 feet, at an estimated cost of $28,998.80.

The work done resulted in a channel 100 feet wide and 3 to 3½ feet deep from Galveston Bay to the Galveston and Brazos River Canal. Beacons were also erected to define the channel. The channel subsequently shoaled to 18 inches in places.

Amount expended, including maintenance, to close of the fiscal year ending June 30, 1907, $35,059.69.

The maximum draft that can be carried at mean low tide June 30, 1909, is 3 feet.

For report of examination upon which new project is based see House Document No. 640, Fifty-ninth Congress, second session.

From records kept by the Gulf, Colorado and Santa Fe Railway Company of vessels passing through the draw of its bridge across West Galveston Bay during the calendar year 1908, 5,054 vessels used the waters of West Galveston Bay.

The U. S. dredge *Gen. H. M. Robert* was engaged during the year in deepening and straightening channel. Up to April 17, 1909, a channel 8 feet deep, 80 feet wide on bottom, was dredged for a distance of 8,800 feet, at which time the dredge was destroyed by fire. A channel was also cut under drawbridge and old piling removed.

Galveston and Brazos River Canal.—This canal was originally dredged by the Galveston and Brazos Navigation Company. The original cut was 10 miles long (made in 1851–1853), 100 feet wide at bottom and 6 feet deep. Steamboats from 145 to 175 feet long and from 28 to 30 feet wide used the canal, carrying from 550 to 1,200 bales of cotton.

The United States purchased the canal in December, 1902, at a cost of $30,000. The canal when acquired by the United States was badly obstructed with snags, drift, and silt.

Previous to June 30, 1907, the canal had been dredged for practically its entire length to a depth of 3 feet at mean low tide and width of from 35 to 40 feet. The bank had been reinforced at various points by brush.

The length of the canal from west end of Oyster Bay to Brazos River is 8¾ miles; ruling depth, 3 feet. The canal connects with West Galveston Bay by a dredged channel across Oyster and Bastrop bays and a new cut across Mud Island, shortening the old route 3½ miles.

Amount expended, including maintenance, on the canal up to the close of the fiscal year ending June 30, 1907, was $67,307.66, of which

$30,000 was for purchase of canal and $3,203.97 applied to maintenance.

The existing project, combining this channel and West Galveston Bay channel under one appropriation, was adopted by the river and harbor act of March 2, 1907, and provides for a channel 40 feet wide and 5 feet deep, at an estimated cost of $151,529 and $20,000 annually for maintenance.

The U. S. dredge *Captain C. W. Howell* has been engaged during the year in deepening the channel to 5 feet, with 1 foot over depth, 60 feet wide, for a distance of 36,910 feet.

A pile-and-brush dike was built across Oyster Creek, where it had cut through south bank of canal. A new boom was constructed at the entrance to the canal into the Brazos River.

The canal is practically completed.

The combined project is about 70 per cent completed.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $124,383.29, of which $20,000 was for maintenance of the improvement.

The total amount expended on the West Galveston Bay and Brazos River Canal project to June 30, 1909, is $226,750.64, of which $30,000 was for the purchase of the canal and $24,589.31 for maintenance.

The maximum draft that can be carried June 30, 1909, at mean low tide over the shoalest part of the channel, which is in West Galveston Bay, is 3 feet.

Variation of water surface is about 1 foot, except at time of Brazos River overflow and northers.

No commercial statistics have been obtained.

July 1, 1908, balance unexpended	$93,193.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	32,000.00
Proceeds of sales of condemned property	.26
Proceeds of sales of contact prints	1.00
Collected from Postal Telegraph Cable Company for digging trench for cable	500.00
	125,694.26
June 30, 1909, amount expended during fiscal year, for works of improvement	66,045.81
July 1, 1909, balance unexpended	59,648.45
July 1, 1909, outstanding liabilities	676.45
July 1, 1909, balance available	58,972.00
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]

(*b*) *Channel from Aransas Pass to Pass Cavallo.*—This channel was originally developed by the State of Texas and private parties and was the old United States mail route between Indianola and Corpus Christi. In 1875 vessels drawing not over 3 feet could navigate the channel.

---

[a] See consolidated money statement on page 491.

The project, as adopted by act of March 2, 1907, contemplates a depth of 5 feet, 40 feet wide, from the entrance at Aransas Pass to Matagorda Bay, a distance of about 63 miles, at a cost of $68,850.

The contract for dredging this channel was continued during the year and is now about 90 per cent completed.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $45,362.81.

The maximum draft that can be carried at mean low tide over the shoalest part of the proposed route is 4 feet.

Variation of water surface, about three-fourths of a foot.

No commercial statistics have been received.

Report of examination is printed in House Document No. 640, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$57,538.58
Amount allotted from appropriation by river and harbor act approved March 3, 1909	40,000.00
	97,538.58
June 30, 1909, amount expended during fiscal year, for works of improvement	37,050.44
July 1, 1909, balance unexpended	60,488.14
July 1, 1909, outstanding liabilities	4,513.41
July 1, 1909, balance available	55,974.73
July 1, 1909, amount covered by uncompleted contracts	12,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*c*) *Guadalupe River, bay section.*—This channel connects the mouth of the Guadalupe River with the channel from Aranses Pass to Pass Cavallo. For the first 8 miles there was 6 feet of water, shoaling to 4 feet at the twelfth mile, then through a flat with about 2 feet to the mouth of the river at the sixteenth mile.

Variation of water surface, about three-fourths of a foot.

The project contemplates a navigable waterway 5 feet deep and 40 feet wide at a cost of $30,000.

During the year 145,983 cubic yards of material have been removed, giving a channel 5 feet deep and 40 feet wide for a distance of 15 miles. The project is about 85 per cent completed.

River section to Victoria, Tex.—The Guadalupe River empties into San Antonio Bay, 16 miles from the inland waterway on the coast of Texas. Its width varies from 90 feet at main entrance at mouth, increasing to 140 feet 52 miles above its mouth. The depth varies from less than 3 feet over shoals to 20 feet at bends. Thick overhanging trees, numerous snags, and sunken logs, together with rafts of recent formation, are found in the lower river. The river was formerly navigated to Victoria, 52 miles from its mouth, but owing to rafts navigation has been abandoned in recent years.

The project contemplates the removal of rafts, snags, etc., and the dredging of shoals to 5 feet, at a cost of $62,700.

---

[a] See consolidated money statement on page 491.

During the year the U. S. combination snag boat and dredge *Guadalupe* removed 53,065 cubic yards of material and several miles of snags and rafts, clearing the river from Victoria at mile 52 to mile 14. There has been no uniform depth obtained by this work, as the dredge has excavated only sufficient depth to enable it to proceed down the river, as the first work to be done was the removing of rafts, snags, etc.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $68,258.60.

From report received from P. R. Austin, 1,150 bales of cotton and 250,000 feet of lumber, together with a considerable quantity of other supplies and products, have been transported over the part of the river at present navigable.

Report of examination is printed in House Document No. 336, Fifty-ninth Congress, second session.

July 1, 1908, balance unexpended	$33,799.97
Amount allotted from appropriation by river and harbor act approved March 3, 1909	50,000.00
Amount appropriated by sundry civil act approved March 4, 1909	32,000.00
	115,799.97
June 30, 1909, amount expended during fiscal year, for works of improvement	41,358.02
July 1, 1909, balance unexpended	74,441.95
July 1, 1909, outstanding liabilities	14,672.13
July 1, 1909, balance available	59,769.82
July 1, 1909, amount covered by uncompleted contracts	5,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, in addition to the balance unexpended July 1, 1909	[a]
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*d*) *Turtle Cove channel between Aransas Pass and Corpus Christi.*—This is a natural depression between Harbor and Mustang Islands connecting at high tide the waters of Aransas and Corpus Christi bays. It is about 13,500 feet long and 2,000 feet wide, with approximate depth of 1½ feet below mean low tide.

Variation of water surface is about 1 foot.

The project contemplates a channel 8½ feet deep at mean low tide and 75 feet wide at the bottom, at a cost of $123,750.

During the year 923,068 cubic yards of material was excavated, making a channel 8½ to 9 feet deep and 75 feet wide on the bottom, from 9 feet of water in Aransas Pass Gorge near the town of Tarpon to Corpus Christi Bay, a distance of 31,400 feet.

The project has been completed.

Amount expended on existing project to close of fiscal year ending June 30, 1909, $122,107.64.

The maximum draft that can be carried at mean low tide over the shoalest part of this locality is 8½ feet.

For report of survey, see House Document No. 338, Fifty-ninth Congress, second session.

---

[a] See consolidated money statement on page 491.

One small steamboat and several schooners use this channel in transporting freight between Galveston and Corpus Christi.

This channel not having been opened to navigation until April, 1909, practically no freight has been carried through same as yet.

July 1, 1908, balance unexpended	$100,411.28
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
Amount appropriated by sundry civil act approved March 4, 1909	23,000.00
Proceeds of sales of contact prints	12.75
	133,424.03
June 30, 1909, amount expended during fiscal year, for works of improvement	121,768.52
July 1, 1909, balance unexpended	11,655.51
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, in addition to the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CONSOLIDATED.

July 1, 1908, balance unexpended	$284,942.83
Amount allotted from appropriation by river and harbor act approved March 3, 1909	132,000.00
Amount appropriated by sundry civil act approved March 4, 1909	55,000.00
Proceeds of sales of condemned property	.26
Proceeds of sales of contact prints	13.75
Collected from Postal Telegraph Cable Company for dredging trench for cable	500.00
	472,456.84
June 30, 1909, amount expended during fiscal year, for works of improvement	266,222.79
July 1, 1909, balance unexpended	206,234.05
July 1, 1909, outstanding liabilities	19,861.99
July 1, 1909, balance available	186,372.06
July 1, 1909, amount covered by uncompleted contracts	18,000.00
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix T 9.)

10. Operating and care of West Galveston Bay and Brazos River Canal, Texas.—A boom tender was stationed during the year to tend the boom at the entrance to the canal into the Brazos River.

---

[a] See consolidated money statement on this page.

July 1, 1908, balance unexpended	$211.56
Amount allotted June 24, 1909	38.44
	250.00
June 30, 1909, amount expended during fiscal year, for works of improvement	120.00
July 1, 1909, balance unexpended	130.00
July 1, 1909, outstanding liabilities	10.00
July 1, 1909, balance available	120.00

(See Appendix T 10.)

11. *Mouth of Brazos River, Texas.*—The mouth of the river was originally obstructed by a bar, the crest of which was about three-eighths of a mile from the shore line, and the channel across afforded a variable depth of water for navigation of not over 8 feet at times (in October, 1874, only 2½ to 3 feet), being subject to changes due to winds, tides, and stages of water.

The orginal project was adopted in 1880 for the improvement of the channel over the bar by the use of jetties. The work was suspended in 1889. The amount expended on original project prior to operations under existing project was $142,098.43, and an additional sum of $5,000 for a board of engineers to ascertain character and value of improvements made by the Brazos River Channel and Dock Company.

After suspension of work by the United States the improvement of the mouth of this river was undertaken by the Brazos River Channel and Dock Company, which constructed two parallel jetties 560 feet apart. The northeast jetty was extended 4,708 feet long and the southwest 5,018 feet. In 1899 this company complied with the conditions of an act of Congress requiring a transfer to the United States of the jetties and auxiliary works; also a release of all rights and privileges conferred upon said company by its charter or by the act of Congress approved August 9, 1888, to charge or collect tolls for the use and navigation of said river. From the transfer of the works until the adoption of the present project the United States spent $88,524.13.

The Brazos River Channel and Dock Company's map shows that in March, 1889, there was a channel depth of 6 feet before the work began, and later, in March, 1896, there was 20 feet. The company measured their depth from a plane of "average flood tide," or mean high water, 1.3 feet above the United States standard of mean low tide. The channel width is about 440 feet. The depth of channel varies with storm conditions and frequency of river floods from 12 to 20 feet.

The existing project (act June 13, 1902) is to repair and strengthen the jetties, construct spur dikes and bank protection, and to dredge a channel 18 feet deep and 150 feet wide. The estimated cost, $250,000, was increased by $175,000 after the hurricane of September 8, 1900. The project is completed except for dredging necessary to obtain and maintain the channel.

As the result of an examination authorized by the river and harbor act approved March 2, 1907, the Board of Engineers for Rivers and Harbors arrived at the conclusion that for the present no further improvements should be made at the mouth of the Brazos River and that work under the existing project should be confined to the maintenance of the jetties, and this opinion is concurred in by the Chief of Engineers. (See H. Doc. No. 1087, 60th Cong., 2d sess.)

It is proposed, therefore, to apply the balance available to maintenance of the jetties.

The amount expended on the work of existing project up to close of fiscal year ending June 30, 1909, is $218,205.58.

The latest information shows a minimum depth on the bar of 16 feet at mean low tide.

Mean range of tide 1.77 feet.

So far as known no vessels carrying freight have used this channel during the year.

So far this improvement has had little or no effect on freight rates.

July 1, 1908, balance unexpended	$17,435.52
Proceeds of sales of condemned property	.16
	17,435.68
June 30, 1909, amount expended during fiscal year, for works of improvement	5.00
July 1, 1909, balance unexpended	17,430.68

(See Appendix T 11.)

12. Aransas Pass, Texas.—Aransas Pass is on the south coast of Texas, 175 miles southwest of Galveston and 125 miles north of the Rio Grande, and is the outlet of Aransas Bay into the Gulf of Mexico. The area of the bay is about 80 square miles. It is connected with Corpus Christi Bay on one side and with the Mesquite, St. Charles, and Copano bays on the other.

The depth over Aransas bar has varied greatly—from 9 feet in 1852, 9½ feet in 1871, 7 feet in 1875, to 8½ feet in 1887.

For projects and work done by the United States Government and private corporations at Aransas Pass, see Annual Report of the Chief of Engineers for 1898, page 1527 et seq.

Amount expended on the original and the modified government project prior to operations under the Aransas Pass Harbor Company's project was $540,477.65, exclusive of $9,938.93 subscribed by the citizens of Rockport and Corpus Christi, Tex., and $5,000 appropriated for Board of Engineers to ascertain character and value of improvements of Aransas Pass Harbor Company.

The last appropriation had been expended in accordance with the project prepared by Maj. O. H. Ernst, Corps of Engineers, in 1887 (printed on pp. 1313 to 1315 of the Annual Report of the Chief of Engineers for 1888). This project called for two parallel jetties and the revetment of Mustang Island.

Under the provisions of the river and harbor act of March 3, 1899, the Aransas Pass Harbor Company, under date of March 27, 1899, released and surrendered all rights and privileges theretofore granted to it by Congress, including the jetty constructed at the entrance of the pass.

The river and harbor act of June 13, 1902 appropriated $250,000, and provided—

> that the work at this harbor shall be confined to the completion of the north jetty in accordance with the design and specifications of the Aransas Pass Harbor Company, and in continuation of the work theretofore carried out on said jetty by said company,

and to such additional work as may be necessary for strengthening such jetty, and for the removal of such part of the old government jetty and any other hard material which may interfere with the formation of a channel by the natural action of the currents.

And the act of March 3, 1905, provided for continuing the improvement, with the proviso—

that the amounts herein appropriated and authorized shall be applied to the completion of the project in accordance with the design and specifications of the Aransas Pass Harbor Company, and in continuation of the work heretofore done, and to such additional work as may be necessary for strengthening the jetty.

Work was completed in accordance with the above-mentioned specifications June 11, 1906, at a cost to the Government of $546,703.10.

After the completion of the north jetty, in accordance with the above-mentioned specifications, the channel became steadily worse, approaching dangerously near the jetty and showed a marked tendency to break through the interval between the inner end of the jetty and the shore. The minimum depth in the thalweg was 16¼ feet at the time of the last survey before beginning work on the new project, but the thalweg was in places directly over the foot of the jetty and there was a navigable channel 6 feet deep of only 100 feet wide, the 6-foot contour having approached to 100 feet from the foot of the jetty. The 12-foot contour approached to within 75 feet of the foot of the jetty, and therefore the 12-foot channel was too close to jetty to be navigable for any vessel of that depth.

A secondary channel, 600 feet wide and 6 feet deep, broke through the gap between jetty and shore with the result that for all practical purposes the channel was on the north side of the jetty instead of the south side, as intended by the plan adopted by the Aransas Pass Harbor Company.

The existing project, adopted by the river and harbor act of March 2, 1907, provides for improvement in accordance with plans submitted by the Board of Engineers for Rivers and Harbors in its report of December 22, 1906, printed in River and Harbor Committee Document No. 5, Fifty-ninth Congress, second session. This project provides, in the main, for a south jetty parallel to the general direction of the existing jetty and the extension shoreward of the north jetty to connect with St. Josephs Island, and later the extension of both jetties. The estimated cost of the work, including $100,000 for a dredge, is $1,288,699.50.

The act of March 2, 1907, authorized the expenditure of $490,000, and contract was entered into December 24, 1907, and was completed June 23, 1909. Under this contract the north jetty was connected with the shore and extended across St. Josephs Island, and a south jetty was started and extended 3,000 feet.

The act of March 3, 1909, authorized the Secretary of War to enter into contract to the extent of $350,000 for new work, and appropriated $100,000 for maintenance for repairs to the old north jetty. A new contract for work to be paid for by the amount above mentioned has been entered into, but work has not yet begun.

As soon as the gap between the north jetty and shore was closed conditions began to improve, and at the end of the fiscal year the channel had widened and deepened so that there now exists a 6-foot channel 430 feet wide, a 12-foot channel 275 feet wide, and the 18-foot contours have approached to within 375 feet of each other.

The conditions are changing rapidly, the improvement noted having taken place during the last five months.

The amount expended on the work of revised project up to the close of the fiscal year ending June 30, 1909, was $484,122.62.

The usual range of tide is 1.1 feet across the bar.

The work done is not believed to have had any effect on freight rates as yet.

During the calendar year 1908 there was carried from and to the wharves of Corpus Christi, Tex., through Aransas Pass, Tex., 5,802,000 pounds of miscellaneous freight and 3,570 bales of cotton.

The balance available and the appropriation recommended will be applied toward extending and maintaining the jetties in accordance with the approved project.

July 1, 1908, balance unexpended	$373,348.45
Amount allotted from appropriation by river and harbor act approved March 3, 1909	100,000.00
Amount appropriated by sundry civil act approved March 4, 1909	90,000.00
Proceeds of sales of condemned property	1.00
Proceeds of sales of contact prints	2.40
	563,351.85
June 30, 1909, amount expended during fiscal year, for works of improvement	453,396.77
July 1, 1909, balance unexpended	109,955.08
July 1, 1909, outstanding liabilities	402.85
July 1, 1909, balance available	109,552.23
Amount (estimated) required for completion of existing project	[a] 350,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, in addition to the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 350,000.00

(See Appendix T 12.)

13. Harbor at Brazos Santiago, Tex.—The navigable depth over the bar before the improvement started was usually from 6 to 8 feet at mean low water.

The project for the improvement of this harbor, adopted in 1881, contemplated the construction of two jetties extending out into the Gulf of Mexico about 1,500 feet apart, one, the south or Brazos Island jetty, to be 3,630 feet long, and the other, the north or Padre Island jetty, to be 2,940 feet long. Work was suspended on this improvement in October, 1884, and the subject of the new improvement was reported on by The Board of Engineers. The cost of an improvement to consist of two parallel jetties placed about 1,100 feet apart was estimated at $1,130,000. Adding previous expenditures of $188,590.23 to this estimate makes the revised cost of the improvement $1,318,590.23. Appropriations ceased in 1888 and no work has been performed on the entrance channel since that time. No permanent increased depth was obtained over the bar.

During the fiscal year 1905 a channel 70 feet wide on the bottom, with a least depth of 10 feet, was excavated from deep water inside the bar in a straight line across the Laguna Madre to the railroad wharf at Isabel, Tex., a distance of 12,000 feet; also a turning basin 400 feet long by 300 feet wide and 10 feet deep.

---

[a] This amount applies to only such work as Congress has specifically authorized to be completed under continuing contract.

Prior to dredging this channel and turning basin there was a natural channel permitting boats drawing 5½ to 6 feet to navigate across the Laguna Madre from the bar to the railroad wharf at Isabel, Tex., at high tide. With the channel and turning basin completed, light-draft steamers and sailing vessels that could get over the bar could proceed direct to the railroad wharf at Isabel, Tex., and unload, in place of being lightered off Brazos Island.

This channel has shoaled in places to less than 6 feet at mean low tide. The tidal range is from 1½ to 2 feet.

The amount expended on this improvement to June 30, 1909, was $247,913.81.

The latest information gives 7½ feet as the minimum depth on the bar.

No commercial statistics have been obtained.

July 1, 1908, balance unexpended	$5,586.22
June 30, 1909, amount covered into surplus fund of the Treasury	5,586.22

(See Appendix T 13.)

14. Construction of sea wall, embankment, and fill along the front of Fort Crockett Reservation, Galveston, Tex., and constructing sea wall from Thirty-ninth street to the west line of Forty-fifth street, in the city of Galveston.—The sundry civil act approved April 28, 1904, contained an item for the protection of the sea front of the Fort Crockett Reservation, and appropriated $591,046.25 for the purpose.

By sundry civil act approved June 30, 1906, an additional amount of $158,953.75 was appropriated for completing the work.

Construction of the sea wall and riprap embankment along the western boundary of the reservation was completed October 18, 1905.

This work was carried out in accordance with report of Board of Engineers, dated December 19, 1902. See Appendix W 13, Report of Chief of Engineers, 1903.

The work of filling and sodding the reservation and behind the sea wall between Thirty-ninth and Forty-fifth streets was completed.

A retaining wall along the north and east sides of the reservation was completed. The reservation is now surrounded by retaining walls.

The amount expended on existing project to June 30, 1909, was $702,338.69.

July 1, 1908, balance unexpended	$143,596.17
June 30, 1909, amount expended during fiscal year, for works of improvement	95,934.86
July 1, 1909, balance unexpended	47,661.31
July 1, 1909, outstanding liabilities	101.42
July 1, 1909, balance available	47,559.89

(See Appendix T 14.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination and survey of Pass Cavallo-Port Lavaca channel, Texas.*—Reports dated March 20, 1908, and May 28, 1908, respectively, are printed in House Document No. 1082, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $10,000 is presented.

2. *Preliminary examination of the mouth of Brazos River, Texas, with a view to determining what further improvements, if any, should be made thereon.*—Report dated February 6, 1908, is printed in House Document No. 1087, Sixtieth Congress, second session. No further improvements are considered necessary at the mouth of the Brazos River at the present time.

3. *Preliminary examination and survey of Colorado River, Texas, with a view of obtaining a navigable channel from its mouth as far up as practicable.*—Reports dated October 21, 1907, October 28, 1908, and November 9, 1908, respectively, are printed in House Document No. 1211, Sixtieth Congress, second session. The locality is not considered worthy of improvement by the United States at the present time.

4. *Preliminary examination of Arroyo Colorado, Texas, with a view to obtaining a channel 8 feet or less in depth from Harlingen to deep water at Point Isabel.*—Report dated May 11, 1908, is printed in House Document No. 1216, Sixtieth Congress, second session. The locality is not considered worthy of improvement by the United States at this time.

5. *Preliminary examination of Pass Cavallo-Port O'Connor channel, Texas, with a view to establishing a harbor.*—Report dated April 7, 1908, is printed in House Document No. 1217, Sixtieth Congress, second session. The locality is not considered worthy of improvement by the General Government at the present time in the manner proposed.

IMPROVEMENT OF RIVERS AND HARBORS IN THE DALLAS, TEXAS, DISTRICT.

This district was in the charge of Capt. W. P. Wooten, Corps of Engineers, to August 14, 1908, and of Capt. A. E. Waldron, Corps of Engineers, since that date. Division engineers, Col. E. H. Ruffner, Corps of Engineers, to August 31, 1908, and Lieut. Col. Lansing H. Beach, Corps of Engineers, since that date.

1. *Johnsons Bayou, Louisiana.*—This stream empties into Sabine Lake, Texas, and was the water outlet, in fact the only outlet, for the product of a rather thickly settled and fertile country. Preliminary survey made in 1897 showed a minimum depth of channel of 12 feet, and only 2½ feet over the bar at the mouth of the bayou at mean low water.

The project of April, 1899, provided for dredging a 6-foot channel through the bar at the mouth of the bayou of such width as the appropriation ($2,500) would permit.

This work was completed during December, 1899, and a channel 6 feet deep and 60 feet wide secured.

No work has been carried on since 1899, none being considered necessary, and the unexpended balance of the appropriation, $238.65, was carried to the surplus fund in the Treasury on June 30, 1904.

The total amount expended on the original project was $2,261.35.

The river and harbor act of March 2, 1907, appropriated $2,500 for this improvement and an examination of the bar at the mouth of the bayou was made, but the district officer reported this stream to be unworthy of further expenditure for either improvement or maintenance by the United States.

The amount expended on this examination was $46, leaving an unexpended balance of $2,454. In November, 1908, an additional examination was ordered, and made at a cost of $86.50, which resulted in a recommendation by the district officer that the available balance, $2,367.50, be expended in dredging a channel across the bar, using the U. S. dredge *Port Arthur*. This recommendation has been approved, and the dredging will be done as soon as the dredge, which is now undergoing repairs, is available. Report on examination of this stream will be found on page 1790, Annual Report of the Chief of Engineers for 1897.

July 1, 1908, balance unexpended	$2,454.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	86.50
July 1, 1909, balance unexpended	2,367.50

(See Appendix U 1.)

2. *Mouths of Sabine and Neches rivers, Texas.*—Prior to improvement there was 3½ feet of water over the bar at the mouth of the Sabine River, and 3 feet over the bar at the mouth of the Neches River. Dredging was carried on at the mouth of the Sabine River in 1880 and 1895, and a channel 60 feet wide and 7 feet deep secured. At the mouth of the Neches River dredging was carried on in 1880, 1889, and 1895, and a channel 50 feet wide and 5 feet in depth for a length of 8,000 feet was obtained. Funds were exhausted before deep water in Sabine Lake was reached. In 1897 the channel at the mouth of the Sabine River still afforded a depth of 7 feet, while the channel at the mouth of the Neches River had shoaled to 4 feet.

The act of March 3, 1899, appropriated $10,000 for improving the mouths of these streams, the appropriation to include the expense of reexamination of the proposed channel through Sabine Lake by a Board of Engineer officers.

The Board constituted in compliance with this act submitted, on August 11, 1899, a report on the proposed channel through Sabine Lake.

The project approved July 14, 1899, provided for dredging from deep water in Neches River to deep water in Sabine Lake. Under this project an 8-foot channel 7,829 feet in length was dredged from the 7-foot contour in Sabine Lake. A part of the appropriation was expended in deepening the channel across the bar at the mouth of the Sabine River.

The river and harbor act of March 3, 1905, adopted a project for dredging a channel 100 feet wide and 9 feet deep from the mouths of Sabine and Neches rivers to the mouth of Taylors Bayou, through Sabine Lake at or near its western shore, as outlined in a report printed in House Document No. 634, Fifty-eighth Congress, second session, at an estimated cost not to exceed $536,500, with the following provisions: "That the channel may, in the discretion of the Secretary of War, be constructed through the land near the lake for any part of said route" and "that the right of way is furnished without expense to the United States."

Work under this project was begun March 1, 1906, and completed February 20, 1908, having been badly delayed on account of difficulties in securing the right of way.

The river and harbor act of March 2, 1907, authorized the extension of the channel at its southern end to a junction with the Port Arthur Canal and the widening of the canal in front of Port Arthur. Work on the extension was begun April 8, 1908, and was completed May 23, 1908.

Total length of completed canal from Port Arthur Ship Canal to mouth of Sabine River is 84,660 feet, or practically 16 miles. (See p. 1546, Appendix, report of 1908.)

The amount expended to June 30, 1909, was $463,783.62, of which $9,925.29 was expended on original and modified projects prior to the operations under the existing project.

During the fiscal year trespass notices were placed along the line of the canal; a number of floating obstructions were removed from the channel; an office building constructed at Port Arthur bordering on the canal; and 61 mooring piles driven in vicinity of office.

Comparative statement of shipments and receipts.

NECHES RIVER.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Calendar year—			
1902	145,740		
1903	151,672	5,932	
1904	161,516	9,844	
1905	173,504	11,988	
1906	178,656	5,152	
1907	150,040		28,616
1908	156,204	6,164	

SABINE RIVER.

	Tons.	Increase.	Decrease.
Year ending May 31—			
1897	245,364		25,893
1898	275,506	30,142	
1899	270,642		4,864
Calendar year—			
1899	407,372	137,730	
1900	[a] 32,148		375,224
1901	459,909	427,761	
1902	413,174		46,735
1903	325,761		87,413
1904	292,184		33,577
1905	198,210		93,974
1906	409,870	211,660	
1907	405,172		4,968
1908	308,825		96,347

SABINE-NECHES CANAL.

	Tons.	Increase.	Decrease.
Calendar year 1908	110,992		

[a] Incomplete; full statistics could not be obtained.

For reference to reports of examinations and surveys see Annual Reports of the Chief of Engineers for 1906, page 406, and 1908, page 486.

July 1, 1908, balance unexpended	$87,721.60
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,001.62
July 1, 1909, balance unexpended	82,719.98
July 1, 1909, outstanding liabilities	218.40
July 1, 1909, balance available	82,501.58

(See Appendix U 2.)

3. *Operating and care of Port Arthur Canal, Texas.*—This service is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation, under the provisions of section 4 of the river and harbor act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

Under the provisions of an act of Congress approved June 29, 1906, there was conveyed to the United States, free of cost, the Port Arthur Canal, the lumber basin, and the turning basin, together with a strip of land along the canal. The deed of conveyance from the Port Arthur Channel and Dock Company was accepted by the Secretary of War on December 13, 1906, from which date the canal became a public water of the United States. Cession of jurisdiction over the property was executed by the governor of the State of Texas on February 27, 1907.

The Port Arthur Canal was built by a company interested in establishing a port somewhat removed from the Gulf, and was dredged to a depth of 25 feet. A dredge which was operated in maintaining the canal for over three years has been purchased by the United States.

A survey of the canal was completed May 10, 1907, and the following table gives a summary of the condition of the canal upon its acceptance by the United States:

	Length.	Average top width.	Width between 20-foot contours.	Maximum depth.	Minimum depth.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Canal	37,600	200	80	25.1	23.5
Turning basin	1,800	625	530	27.1	23.7
Lumber basin	1,200	160	100	26.2	23.1

The depths above given are referred to mean low Gulf level, and the usual variation of the tide is 1½ feet.

Operations during the year have consisted in dredging shoal places in the canal to a depth of 26 feet for a distance of 13,900 linear feet, and making extraordinary repairs to the U. S. dredge *Port Arthur*. The turning and lumber basins having shoaled considerably, authority was granted to hire outside dredging plant to do necessary dredging in these two basins. Contract was entered into on June 29, 1909, for dredging about 220,000 cubic yards therein at a cost of 10½ cents per cubic yard, work to commence not later than August 1, 1909.

The maximum usable depth in the canal on June 30, 1909, was 24½ feet.

The amount expended to June 30, 1909, was $66,009.18 exclusive of outstanding liabilities, of which $21,097.36 was expended during the past year.

There were moved on this canal during the calendar year of 1908 1,174,415 tons of miscellaneous freight, consisting principally of crude petroleum and its refined products, cotton, lumber, and general merchandise, valued at $21,405,118.

(See Appendix U 3.)

4. Harbor at Sabine Pass, Tex.—Prior to improvement there were depths of 18 and 17 feet, respectively, over the two bars in Sabine Pass, opposite the town of Sabine and opposite Fort Point. These bars were about 200 feet long. Throughout the other portions of the pass the least mean depth was 25 feet.

Beyond the shore line at the entrance to the pass there existed a bar about 3½ miles wide between the interior and exterior 18-foot bottom curves, over which there was not more than 6 feet of water at mean low tide. Channels 12 and 15 feet deep were dredged through this outer bar during 1878 and 1880, under the project of 1873, at a cost of $325,000, but they soon refilled.

The project of 1882 provided for the construction of parallel jetties at the entrance of the pass, 1,800 feet apart and about 4 miles in length from shore line to deep water in the Gulf, and for dredging the channel between these jetties if necessary. This work was designed to provide a channel of practicable width and a depth of 25 feet at an estimated cost of $3,177,606.50.

Construction of the jetties began in 1883, and under successive appropriations has been carried on since that date.

The river and harbor act of 1896 authorized contracts for the completion of the project, limiting the cost to $1,050,000, all of which has been appropriated.

Under contract approved June 22, 1897, the east jetty was completed for a length of 21,818 feet, riprap work only was completed for a length of 682 feet, and foundation only for 2,600 feet. The west jetty had a length of 15,560 feet, of which 1,490 feet was only riprap work and 4,950 feet was foundation only. About 3,000 feet of previous work was capped.

Dredging in the channel was carried on, under contract, in 1897, 1898, and 1899, the depth being increased to 25 feet and the width to 100 feet. The channel was again dredged in 1900 and 1901, with an allotment of $8,000 from the emergency appropriation of June 6, 1900.

Under the act of March 3, 1899, $150,000 was appropriated for straightening, widening, and otherwise improving the harbor by the removal of oyster reefs and flats between the United States life-saving station and a point opposite the United States light-house. The work was completed April 18, 1903.

Act of June 13, 1902, appropriated $25,000 for widening and straightening the main ship channel and increasing its depth from a point 1,000 feet north of the life-saving station to the entrance of the Port Arthur Canal in accordance with report published in the Annual Report of the Chief of Engineers for 1901, page 1915. This work was completed February 27, 1903, and the channel depth was increased to 25 feet at mean low water for an average width of 400 feet.

The act of June 4, 1897, appropriated $100,000 for the construction of a dredge (the *Sabine*), which was completed January 14, 1901.

Since this date the dredge has worked in the channel between the jetties seventy-five months and eight days and removed a total of 3,233,335 cubic yards. The remainder of the time she was either absent undergoing repairs or was engaged in emergency work at South Pass, Mississippi River.

The creation of the channel contemplated by the project has been completed. The existing project is for maintenance of a channel depth of 25 feet to be accomplished by dredging and the restoration of the jetties to a height of about 4 feet above mean low tide at an estimated cost of $1,016,573.

The act of March 2, 1907, appropriated $160,000 for continuing improvement and for maintenance and authorized contracts for materials or work to the amount of $200,000, which has been appropriated and expended in repairing the east jetty for a distance of 13,800 feet, 113,893.31 tons of riprap stone being used for this repair work, the contract being completed December 19, 1908.

Allotment of $200,000 was made from the appropriation act of March 3, 1909, to continue this improvement, and for maintenance.

Operations during the year have consisted in repairing east jetty and dredging channel between the jetties.

At favorable stages of the tide vessels have gone out during the year drawing 25½ feet. The usual variation of the tide is 1½ feet. By continued work the dredge *Sabine* is able to maintain only a very narrow channel of about 24 feet depth, and additional work is badly needed toward building up the low portions of the jetties to a height of about 4 feet above mean low tide.

The amount expended to June 30, 1909, was $4,129,896.83, of which $325,000 was expended on previous projects. Of the amount expended on the present project it is estimated that $290,497.03 has been applied to maintenance of improvement.

The amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, namely $300,000, will be applied to continuing the work of raising and repairing jetties and dredging in the channel.

Comparative statement of shipments and receipts.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1897	87,632	38,746	....
1898	238,400	150,768	....
1899	326,982	88,582	....
Calendar year—			
1899	326,494	....	488
1900	217,489	....	109,005
1901	150,087	....	67,402
1902	689,688	539,601	....
1903	1,315,248	625,560	....
1904	1,792,371	477,123	....
1905	1,779,954	....	12,417
1906	1,904,389	124,435	....
1907	1,848,159	....	56,230
1908	1,802,307	....	45,852

Of the tonnage moved during the calendar year 1908, 65 per cent passed through Sabine Pass on its way to or from the Port Arthur Canal.

It would appear that the result of the improvement at Sabine Pass had had a marked effect in decreasing the freight rate on shipments to the seaboard, as the State railway commission has given Sabine and Port Arthur a low rate, called a differential, of 7 cents per hundred on first-class freight from Beaumont to Sabine or Port Arthur, applying on all freight from interior points in Texas to Sabine or Port Arthur. This was done merely to equalize the rate, or differential, from Houston to Galveston, and was done only when it was shown to the commission that Sabine and Port Arthur were deep-water exporting points. It amounts to this: That all freight from interior Texas points for export through Sabine or Port Arthur pays the regular tariff rates to Beaumont, plus but 7 cents first-class freight, to be then hauled to Sabine, though the regular tariff from Beaumont to Sabine is 20 cents.

On page 407, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of Sabine Pass.

July 1, 1908, balance unexpended		$194,622.28
Amount appropriated by sundry civil act approved March 4, 1909		10,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		200,000.00
Collected in suit United States *v.* Charles Clarke & Co		302.93
Received from sale of blueprints		3.50
		404,928.71
Reverted to Treasury		1,194.56
		403,734.15
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$177,424.62	
For maintenance of improvement	27,657.47	
		205,082.09
July 1, 1909, balance unexpended		198,652.06
July 1, 1909, outstanding liabilities		1,334.08
July 1, 1909, balance available		197,317.98
Amount (estimated) required for completion of existing project		[a] 456,573.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		300,000.00

(See Appendix U 4.)

5. *Brazos River, Texas, from Old Washington to Waco.*—The profile of this section of river shows an alternating series of steep and gentle slopes, not navigable, above Hidalgo Falls.

---

[a] This amount is the difference between the original estimate and the sum of the subsequent appropriations which have been applied to the work contemplated by it. Owing to the fact that as favorable prices have not been obtained as were expected, the figures now given are probably not a correct estimate of the further amount that will be required to complete the project. This matter will receive consideration, with a view to reporting a revised estimate to Congress, in connection with an examination now being made of this locality or in the next annual report.

In the river and harbor act of March 3, 1905, an examination of this section was ordered and a provisional appropriation for its improvement was made. In the act of March 2, 1907, a further appropriation was made, in accordance with a project submitted in a report published in House Document No. 705, Fifty-ninth Congress, first session. This project contemplates securing a navigable depth of 4 feet for four months and 3½ feet for six months of the year by constructing eight locks and dams and 103 miles of open-channel work, at a total cost of $2,915,000. It is not clear to what extent the project outlined therein may be regarded as adopted by Congress in appropriating for the work, and thus far it has been assumed that the Government is committed to the construction of only one lock and dam at an estimated cost of $300,000.

The river and harbor act of March 2, 1907, authorized continuing contracts in the sum of $150,000, in addition to amounts already appropriated for the completion of the lock and dam at Hidalgo Falls, which amount has been appropriated.

From the amount of money appropriated by river and harbor act of March 3, 1909, the sum of $75,000 was allotted. This allotment was required in addition to the $300,000 to repair flood damages and to construct bank protection to prevent further erosion at site of the lock.

On June 30, 1909, $233,830.04 had been expended on the construction of lock and dam at Hidalgo Falls.

During the fiscal year $85,244.40 has been expended in completing the construction, by hired labor, of the lock, with the exception of lock gates, controlling valves, maneuvering devices, and also in the placing of bank protection and repairing flood damages.

No work on the project has been done except the building of the lock and dam at the foot of Hidalgo Falls, which work is about 55 per cent completed, so that no change has been made in this stretch of the river.

Should this portion of the river, as well as that below Old Washington, be properly improved, there is no doubt that the improvement would cause a great reduction in freight rates throughout the contiguous country.

If it is the intention of Congress to continue the improvement by the construction of additional locks and dams, money should be provided in sufficient amount to enable the improvement to be carried on more rapidly than it has been in the past.

For reference to reports of examinations and surveys see Annual Report of Chief of Engineers for 1907, page 452.

July 1, 1908, balance unexpended	$101,414.36
Amount appropriated by sundry civil act approved March 4, 1909	50,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	75,000.00
Received from sale of blueprints	7.75
	226,422.11
June 30, 1909, amount expended during fiscal year, for works of improvement	85,244.40
July 1, 1909, balance unexpended	141,177.71
July 1, 1909, outstanding liabilities	6,255.81
July 1, 1909, balance available	134,921.90

(See Appendix U 5.)

6. *Brazos River, Texas, from Velasco to Old Washington.*—This section of the river has a width of from 200 to 400 feet. It has good depth from the mouth to near the head of tide water above Columbia (mile 36). It is navigable for light-draft boats throughout its length for about eight months in the year.

The original project for this improvement was adopted June 3, 1896, and contemplated the removal of snags and overhanging trees and dredging troublesome shoals between Velasco and Richmond only. The sum of $5,000 was expended on this project.

In the river and harbor act of June 13, 1902, the improvement from Richmond to Old Washington was undertaken. In the act of March 3, 1905, this improvement was continued from Velasco to Old Washington. The project on which these appropriations were based (see Report of the Chief of Engineers, 1901, p. 1974) contemplated the improvement of the river by open-channel work between the mouth and Old Washington, at a cost of $225,000.

Amount expended on work of existing project up to June 30, 1909, was $216,864.51.

The operations during the year consisted in constructing and repairing jetties, removing obstructions by snagging, and repairing plant. Below mile 110 (or 10 miles above Richmond) a depth of 4 feet for approximately eight months in the year has been obtained between Velasco and Richmond. The project in this part of the river is about 90 per cent completed. From Richmond to Old Washington no work of any consequence has been done during the year, the project being about 50 per cent completed. Over this section a depth of 4 feet is available for navigation by boats having considerable power during rises of from 1 to 2 feet. No commerce of any note has developed, nor can any be expected until the Brazos River is improved from its mouth up to Waco, or until the territory about the lower portion is given over more to agriculture than it is now.

The distances of the various places mentioned in the above report from the mouth of the river are as follows: Velasco, 5 miles; Columbia, 35 miles; Richmond, 99 miles; Rosenberg, 108 miles; Old Washington, 254 miles; Navasota Lock, 259 miles; Waco, 424 miles.

The improvement has so far caused no effect on freight rates.

The available balance, as well as the $55,000 requested for the fiscal year ending June 30, 1911, will be used to build the new snag boat *Waco* and in keeping plant in operation on open-channel work.

For reference to reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1907, page 453.

July 1, 1908, balance unexpended		$54, 326. 78
Amount transferred from Galveston district account of repairs to dredge		15, 000. 00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25, 000. 00
Received from sales		18. 00
		94, 344. 78
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$16, 328. 96	
For maintenance of improvement	4, 862. 33	
		21, 191. 29
July 1, 1909, balance unexpended		73, 153. 49
July 1, 1909, outstanding liabilities		3, 079. 43
July 1, 1909, balance available		70, 074. 06

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	$55,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1907, and of section 7 of the river and harbor act of 1899.	

(See Appendix U 6.)

7. *Trinity River, Texas.*—The river in its upper reaches is a narrow stream with a low-water depth insufficient for even light-draft navigation. Its banks are generally high and quite stable, making it particularly susceptible to improvement by canalization.

The river and harbor act of June 13, 1902, adopted a project for the improvement of this stream in accordance with a report submitted in House Document No. 409, Fifty-sixth Congress, first session. (See Annual Report of the Chief of Engineers for 1900, p. 2348.) This project contemplated improvement to provide a 6-foot navigation from Dallas to the mouth, a distance of 511 miles, by open-channel work and a system of locks and dams.

The original estimate of cost of this improvement was $4,550,000. The portion of this applicable to section 1 ($350,000) was afterwards raised to $918,000 in a report from a board of engineers appointed to examine into the cost. (See Annual Report of the Chief of Engineers for 1904, p. 2021.)

The amount expended on this improvement up to June 30, 1909, was $430,541.40.

Four locks and dams in section 1 have already been provided for by Congress. The money for Nos. 1, 2, and 6 has already been appropriated, and funds have been appropriated and authorized for No. 4 and for a lock and dam at Hurricane shoals, which is in section 2, and of the authorization, $85,000 is yet to be appropriated.

During the year, Lock and Dam No. 1 was practically completed, and during March, 1909, the contractor moved his force to the mouth of Parsons Slough and commenced work on the dam at this place. The construction of these two dams is covered by one contract. About 65 per cent of work on dam at Parsons Slough has been completed.

The contractor who has the contracts for the construction of Locks and Dams Nos. 2 and 4 has done very little work during the year, except remodeling plant, excavating, and placing cofferdam.

Work on Lock and Dam No. 6 has progressed more favorably this year, and about 60 per cent of the contract has been completed.

For the reasons given in the local officer's report it has been found necessary to increase the estimate for Locks and Dams No. 4, in section 1, and at Hurricane shoals, in section 2. He states that approximately $85,000 will be needed in addition to the $85,000 now covered by continuing-contract authorization and not yet appropriated, making the total further amount that will be required to be appropriated to complete these works $170,000 and that this additional $85,000 should be provided for by cash appropriation or contract authorization.

Lock No. 1 is at McComas Bluff, 13 miles below Dallas; the dam at Parsons Slough is 22 miles below Dallas; and Locks Nos. 2, 4, and 6 are 23, 30, and 42 miles, respectively, below Dallas.

Snagging operations were continued on the lower river.

The expenditures made in cleaning the river have resulted in no increased depth, but the removal of snags and drifts has made the stream safer to navigate at medium and high stages. There is no navigation of account above Liberty other than the rafting of logs.

Owing to the fact that the river is not yet navigable to Dallas, the only place at which it can come into active competition with the railroads, no effect on freight rates has been produced. Inasmuch as the leading trunk lines of this section are crossed by the river at Dallas, there can be no doubt that when the river is made navigable to this point it will result in a considerable reduction and an immense saving, not only in local, but also in interstate freight rates in this section.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1906, page 431.

If it be decided to prosecute this project further, provision should be made in the shape of increased appropriations.

July 1, 1908, balance unexpended		$488,877.64
Amount appropriated by sundry civil act approved March 4, 1909		125,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		75,000.00
Received from sale of blueprints		11.00
		688,888.64
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$107,026.86	
For maintenance of improvement	12,996.14	
		120,023.00
July 1, 1909, balance unexpended		568,865.64
July 1, 1909, outstanding liabilities		2,921.76
July 1, 1909, balance available		565,943.88
July 1, 1909, amount covered by uncompleted contracts		367,712.31
Amount (estimated) required for completion of existing project		[a] 170,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		[b] 183,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix U 7.)

8. Operating and care of Lock and Dam No. 1, Trinity River, Texas.—On March 1, 1909, Lock and Dam No. 1 was placed under the appropriation for operation and care. After the first few operations of the lock a defect was discovered under the lower gates. Upon examination it developed that this was not due to any fault of the contractor, and authority for its repair was approved. Considerable work has been done on these repairs, but final completion has been prevented by small rises in the river.

A telephone has been installed at Lock and Dam No. 1.

There has been expended up to June 30, 1909, $3,518.71.

(See Appendix U 8.)

9. Cypress Bayou, Texas and Louisiana.—During the period of the great raft in Red River the bottom lands of Cypress Bayou were flooded—became lakes—and afforded a navigable route from Red River, near Shreveport, La., to Jefferson, Tex., 65 miles. Work by the United States for the improvement of this route commenced in 1872, and from 1872 to 1879 $94,000 was appropriated for the purpose. The funds were expended for dredging and straightening the channel, removing stumps, snags, and logs, and cutting leaning timber. This work was completed in 1880, but on account of its temporary nature appropriations and allotments aggregating $39,701.33 were made for maintenance.

---

[a] This estimate pertains only to the locks and dams, the construction of which has been specifically authorized by Congress.

[b] Of this amount $85,000 is for continuing contract work authorized by the river and harbor act of March 2, 1907, and $98,000 for open-channel work.

The removal of the raft and the subsequent closure of outlets and construction of levees down the right bank of Red River from the hills in Arkansas to near Shreveport, La., cut off the water supply of the lakes, which, in conjunction with the quicker drainage resulting from the lowering of the bed of Red River, gradually caused them to dry up. In consequence the period of navigation shortened from year to year until 1897, when boats from Red River ceased plying altogether.

The existing project is practically for maintenance by cleaning and clearing the bayou and lakes between Jefferson, Tex., and Mooringsport, La., of snags and other recurring obstructions.

The amount expended to June 30, 1909, was $142,824.28 for improvement and maintenance and $12,613.05 for surveys. The work of maintenance so merges into the work of improvement that it is difficult to state just what portion of the expenditures was for maintenance and what for improvement.

The water supply of the drainage basin of the lakes has been reduced so greatly and the channel of Red River above Shreveport has lowered so much that steamboats now can cross Albany flats, at foot of the lake, only at rare intervals during exceptionally high stages of Red River or after heavy rains in the drainage basin of the lakes.

The work of removing obstructions now in progress has rendered navigation safer between Jefferson and Mooringsport and has consequently caused some increase in the quantity of such local navigation. This navigation by giving access to a competing railroad has resulted in keeping freight rates somewhat below those existing in neighboring sections.

From August, 1908, to February, 1909, the quarter boat was engaged in removing obstructions to navigation between Jefferson, Tex., and Mooringsport, La. The remainder of the time the boat was out of commission on account of high water and lack of funds.

The amount estimated for maintenance of improvement during the fiscal year ending June 30, 1911, is for continuing the work of cleaning the channel of obstructions to navigation.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1906, page 432, and House Document No. 220, Sixtieth Congress, first session, which gives report of examination made of "Caddo Lake with a view to determining advisability of constructing a dam at the foot of said lake on the waterway connecting Jefferson, Tex., with Shreveport, La."

July 1, 1908, balance unexpended	$3,638.02
Amount allotted from appropriation by river and harbor act approved March 3, 1909	6,000.00
	9,638.02
June 30, 1909, amount expended during fiscal year, for works of improvement	3,374.02
July 1, 1909, balance unexpended	6,264.00
July 1, 1909, outstanding liabilities	82.19
July 1, 1909, balance available	6,181.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix U 9.)

10. Red River between Fulton, Ark., and Denison, Tex.—This part of the river was originally navigable for small boats during high stages only. The river at low water is a stream from 100 to 200 feet wide in the bends, winding in a shifting channel between banks which are frequently several hundred yards apart. The low-water depth varies from 1.5 to about 4 feet. The banks are covered with trees constantly caving into the river and forming snags and drifts.

The original appropriation for work above Fulton was made August 5, 1886. The project contemplated improving only high and medium stage navigation by removing snags and drift. Previous to the existing project no work was provided for above the mouth of the Kiamichi River. The amount expended under previous projects is $33,500.

The river and harbor act of March 3, 1905, entered upon a project for the improvement of the river between Fulton, Ark., and Denison, Tex. The project contemplates the removal of drift and snags, clearing the banks of timber in danger of caving into the river, and closing chutes and cut-offs where necessary. No estimate of cost has been made.

At the close of the fiscal year June 30, 1909, $182,737.06 had been expended on this project, of which amount $10,189.66 was expended on survey of river between Fulton, Ark., and mouth of Washita River, Oklahoma.

During the year the snag boat *C. A. Culberson* and 3 quarter boats have been engaged in snagging operations. The 62 miles above Fulton over which the *C. A. Culberson* has worked shows an increasing depth. With the snags removed, the river seems to be cutting itself a deeper and more stable channel.

The survey of the river between Fulton, Ark., and the mouth of the Washita River, Oklahoma, which was commenced in March, 1908, was completed during the year, and report made to the Chief of Engineers.

Beyond the rafting of logs and timber there has been no commerce of any value on this section of the river.

When this section of Red River is opened to regular navigation a very material reduction in both local and through freight rates to points in north Texas and Oklahoma must necessarily result.

To secure a stable improvement will require a continuance of work for a number of years. The available funds and additional appropriation recommended will be applied to continuing the work now under way of removing obstructions and bank clearing.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1906, page 433.

July 1, 1908, balance unexpended		$70,848.30
Amount allotted from appropriation by river and harbor act approved March 3, 1909		40,000.00
		110,848.30
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$48,797.71	
For survey	4,787.65	
		53,585.36
July 1, 1909, balance unexpended		57,262.94
July 1, 1909, outstanding liabilities		2,282.76
July 1, 1909, balance available		54,980.18
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		100,000.00

(See Appendix U 10.)

11. Sulphur River, Texas and Arkansas.—Sulphur River for about 150 miles from its mouth is from 150 to 200 feet wide, with navigable depths, except for a few shoals. The banks are as a rule firm and stable. The stream is, however, badly obstructed by snags and sunken logs.

In 1896 and 1897 the sum of $2,488.99 was expended on snagging operations.

The existing project was adopted by the river and harbor act of March 2, 1907, and contemplates improvement of 150 miles of the river above the Red River by dredging and operation of a snag boat, at an estimated cost of $36,000, assuming that a United States boat is available. Operations during the year consisted in removal of snags and other obstructions by means of a quarter boat.

At the close of the fiscal year $16,968.81 had been expended on this project.

Owing to the poor navigable condition of the stream at present no commerce of any account has developed. As the stream drains a very rich section of the country it is expected that it will be extensively used when improved, and that some reduction in freight rates will result.

It is proposed to expend the available funds and the additional appropriation recommended in clearing the river of obstructions and dredging where necessary.

For reference to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1907, page 457.

July 1, 1908, balance unexpended	$27,860.84
June 30, 1909, amount expended during fiscal year, for works of improvement	8,829.65
July 1, 1909, balance unexpended	19,031.19
July 1, 1909, outstanding liabilities	430.30
July 1, 1909, balance available	18,600.89
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix U 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE VICKSBURG, MISSISSIPPI, DISTRICT.

This district was in the charge of Capt. Clarke S. Smith, Corps of Engineers. Division engineer, Col. Wm. H. Bixby, Corps of Engineers.

1. *Red River, below Fulton, Ark.*—This improvement was undertaken by the United States in 1828, and between 1828 and 1841 more than $425,000 was appropriated for removal of the great Red River raft. When work commenced the raft was 92 miles long, extending from Loggy Bayou, 65 miles below Shreveport, La., to Hurricane Bluffs, 27 miles above. A channel was opened through this obstruction, but, owing to failure of appropriations between 1841 and 1852, additional raft formed. In 1852 $100,000 was appropriated, and in 1857 the agent in charge reported the route opened but not completed, with recommendation for appropriations of $50,000 a year for completion and maintenance. The total amount expended from 1828 to 1857 was $529,831.90. The sum of $3,545.60 was carried to the surplus fund. Nothing further was done for fifteen years, and in that long interval the results of much of the former work were lost.

When work was resumed, in 1872, the river above Shreveport, La., was closed by a raft 32 miles long, which was growing constantly. Below Shreveport the enlargement of an outlet through Tones Bayou was depleting the main channel and threatening its closure to navigation. At Alexandria, La., the falls were impassable at low stages. Navigation was difficult and dangerous at all places and at all times. The channel shifted frequently, and at flood the river overflowed the entire raft region. Both above and below Sherveport the bed of the river was a mass of sunken logs and stumps. The banks were heavily timbered and each flood caused them to cave or slide.

The project entered upon in 1872 contemplated opening navigation through the raft and closing Tones Bayou outlet. Under the river and harbor act of 1878 the removal of wrecks, snags, and other obstructions below Shreveport was commenced, and the act of 1879 authorized the same kind of work above the raft to Fulton, Ark. Work was carried on under three distinct appropriations until 1882, when it was combined in a general appropriation for continuing the improvement from Fulton, Ark., to the Atchafalaya River, Louisiana, with a provision for work at Alexandria, La. The river and harbor acts of 1884 and 1890 contained provisions for closing Sale and

Murphy outlet, Louisiana; the acts of 1888, 1892, and 1894 authorized expenditures for improvement of Cypress Bayou, Bayou Dorcheat, and Sulphur River, tributaries of Red River; the act of 1902 provided for improvement of the channel at Shreveport, La., and the act of 1905 contained a provision for further improvement of the channel at Alexandria, La.

The project was amplified in the river and harbor act of July 13, 1892, to include the systematic clearing of the banks to remove the source of drift and snags; continuing snagging operations and the removal of jams and raft; dredging tow-heads and shoals; constructing a substantial system of levees to fix the course of the river, either alone or by cooperating with riparian States; the closure of all outlets that deplete the river; the fixing of caving banks to confine the river to the selected channel, and the prevention of injuries to regimen by new cut-offs or outlets. The nature of the improvement requires that it be continued for many years, and no estimate for completion is given on this account.

The amount expended from 1872 to the close of the fiscal year ending June 30, 1909, including $5,560.37 derived from sales, was $1,833,983.33, with the following chief results:

The channel cleared through the great raft in 1872–73 opened to navigation 188 miles of river above Shreveport to Fulton. Subsequent work secured the complete removal of the raft, prevented formations of the same nature, increased the width of the river 100 feet or more, and there now flows in the course laid out for it in the old raft region a broad and deep river, safe for navigation at all but the lowest stages. The survey of 1908 showed that the bed of the river in the old raft region above Shreveport had lowered in places as much as 25 feet. Incidentally the removal of the raft drained the fertile valley and reclaimed thousands of acres of productive lands. Tones Bayou outlet is closed by a heavy earthen dam, connected with the line of levee above and below it, and the main channel, for a time called "Little River," has widened and scoured until navigation of the stretch is uninterrupted at low stages. All of the chief outlets along the right bank above Tones Bayou to the Arkansas-Louisiana line, 89 miles, have been closed with dams by cooperation with the State of Louisiana and local levee districts. Work at Alexandria Falls rendered them naviagble at all stages. The channel was deepened from 2½ to 5½ feet at the lower falls and to 6 feet at the upper falls, lengthening the period of navigation about two months. Persistent snagging operations, repeated from year to year, have kept the river open and enabled steamboats to make regular trips, the river from the Atchafalaya to Fulton ordinarily being open for boats of 3-foot draft at stages about a foot above zero of the Shreveport gauge. The maximum draft that can be carried at mean low water is 3 feet to Montogmery, La., 162.5 miles above the Atchafalaya; 2½ feet to Shreveport, 320.5 miles, and 2 feet to Fulton, Ark., 508.6 miles. The range between low and high water at the several gauge stations is as follows: Fulton, Ark., 35.65 feet; Shreveport, La., 41.2 feet; Alexandria, La., 45.5 feet, and Barbre Landing, Louisiana (head of Atchafalaya River), 52.72 feet. Much of the work performed necessarily has been in repetition from time to time, and the items of improvement and maintenance are so closely allied that the cost of each can not be given separately.

At present steamboats seldom run above Fulton, Ark., but at high stages the river is navigable in fact to Denison, Tex., 292 miles above Fulton and 800 miles above the Atchafalaya River.

During the fiscal year ending June 30, 1909, work for maintenance of the improvement was continued as follows: Operations of snag boats, supplemented by those of shore parties during the period of low water, extended over the river between the head of Atchafalaya River, Louisiana, and Fulton, Ark., and unusually heavy work was required on account of the extraordinary flood of 1908, which disturbed the regimen and deposited many snags in the river. In Bossier Parish, La., 9,051 linear feet of levee, containing 124,126 cubic yards of embankment, was built to prevent further breaches in the levee line at that locality, and 50,700 cubic yards of levee embankment were built in Lafayette County, Ark., to aid in closing the Spirit Lake Outlet. A resurvey of the river was made from mouth of Sulphur River, Arkansas, to head of Cane River, Louisiana, 190.5 miles. Plans were under preparation for the construction of a hydraulic dredge, required for the relief of navigation at shoal places during low water.

To maintain what has been accomplished and to gradually secure a more stable improvement will require a continuance of work for many years. The estimated cost is $75,000 a year, or biennial appropriations of $150,000, exclusive of extraordinary demands for new plant that will arise from time to time.

Notwithstanding the facilities for quick transportation afforded by railways, the commerce of Red River until recent years has consisted of large shipments of cotton, cotton seed and its products, lumber, staves, timber, etc., with heavy return freights of general merchandise and plantation supplies.

The commerce and navigation reported for eighteen years showed great variations, due to the changing crop conditions, occasional periods of extraordianry low water during the busy season, and other causes, ranging in quantity from 66,376 to 279,946 tons per annum, with estimated values of from $1,506,500 to $9,185,000. The average for the eighteen years was 123,244 tons, valued at $4,359,900. To this should be added the commerce from Ouachita River, entering Red River at the mouth of Black River, the average of which was 178,070 tons, valued at $6,229,560, making a total of 301,314 tons, valued at $10,589,460.

In 1908, however, there was a marked decline of navigation above the mouth of Black River and the commerce reported in that stretch only amounted to 36,288 tons, valued at $198,240.

The project has effected a reduction of freight rates on all commodities.

For more extended information respecting the work performed, reference is invited to the report and illustrations at page 1909 of the Report of the Chief of Engineers for 1893, and to the subsequent reports of the district officers. Maps of Tones Bayou, Bayou Pierre, etc., were published in the reports of 1882, page 1542, and 1885, page 1490. An index sketch of the basin of Red River and diagrams showing the limits of high and low water were published in the report of 1891, page 1956, and the report of 1892, page 1587. Maps of the river at Shreveport were published in the reports of 1887, page 2682, and 1893, page 1921. Map of the river at Alexandria was printed in House Document No. 462, Fifty-sixth Congress, first session.

References were given in the Annual Report of 1904 to reports of examinations and surveys, with page numbers at which they may be found. (See Report of the Chief of Engineers, 1904, pp. 385 and 386.) Report of an examination of Boyce Landing, Red River, Louisiana, made in 1907, was printed in House Document No. 219, Sixtieth Congress, first session.

The available funds will be applied to continuing the improvement and to maintenance.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to the operation of snag boats and further work on the existing approved project. This additional work is for maintenance and the extension of benefits.

July 1, 1908, balance unexpended	$197,193.60
Amount allotted from appropriation by river and harbor act approved March 3, 1909	65,000.00
Amount received from sales of property	143.40
Amount transferred from appropriation for relief of sufferers from cyclone in certain southern States	[a]2,443.87
	264,780.87
June 30, 1909, amount expended during fiscal year for maintenance of improvement	78,203.83
July 1, 1909, balance unexpended	186,577.04
July 1, 1909, outstanding liabilities	3,819.30
July 1, 1909, balance available	182,757.74
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	75,000.00

(See Appendix V 1.)

2. *Cane River, Louisiana.*—Cane River is one of the abandoned channels of Red River, left out on the westward by cut-offs about 1825 and 1849, and is about 75 miles long from Red River near Grand Ecore to Red River near Colfax. It is made up of pools, bayous, and swamps, and interrupted by deposits considerably higher than the average stage of the main river.

Under the river and harbor act of July 5, 1884, $2,500 was expended for the removal of snags, stumps, caved-in and leaning trees, and some rock, obstructing high-water navigation. This work freed the channel of obstructions to a great extent, increased the navigable depth, and enabled steamboats to make quicker trips at high stages. Operations were then discontinued. Section 5 of the river and harbor act of March 3, 1905, declared Cane River to be not a navigable water of the United States, but this section was repealed by act of Congress approved June 29, 1906.

February 27, 1909, the Secretary of War authorized an allotment of $2,000 from the emergency appropriation provided by the river and harbor act of March 2, 1907, to be applied to restoration of the channel; the shipping interest having reported that the last flood of Red River caused the banks to cave, and in places so filled the stream with trees as to prevent navigation.

---

[a] This is a refundment of actual expenditures made by two snag boats in June and July, 1908, while temporarily employed by the Quartermaster's Department, and the amount, therefore, is not included in the total amount expended for the improvement of Red River.

The total expenditure to June 30, 1909, was $2,922.13, of which $422.13 was applied to maintenance and restoration of the channel under the recent allotment. At high stages small steamboats from Red River ascend Cane River from Colfax to Natchitoches, transporting the products of the country, the principal shipments being cotton seed for mills along Red River.

In June, 1909, work was performed for the removal of obstructions in the lower 40 miles of Cane River, restoring the stream to fairly good navigable condition during the periods of high water. Nothing further is recommended at the present time.

For information respecting the work performed under the act of 1884 reference is invited to the reports of 1885, page 1495; 1886, page 1349; and 1887, page 1452.

Reports of examinations were published in the reports for 1884, page 1366, and 1891, page 2022, the latter also having been printed in House Executive Document No. 184, Fifty-first Congress, second session.

February 27, 1909, amount allotted from the emergency appropriation provided by river and harbor act approved March 2, 1907	$2,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	422.13
July 1, 1909, balance unexpended	1,577.87
July 1, 1909, outstanding liabilities	1,433.78
July 1, 1909, balance available	144.09

(See Appendix V 2.)

3. *Ouachita and Black rivers, Arkansas and Louisiana.*—The improvement of Ouachita River by the United States commenced in 1871. At that time navigation was much obstructed at all stages by snags, sunken logs, wrecks, leaning and caving trees, etc., and the greater part of the river was unnavigable at low water on account of numerous rock, gravel, and sand bars.

The project of 1871 contemplated temporary improvement from Trinity, La., to Arkadelphia, Ark., by removal of snags, etc., and by dredging the worst bars. In 1872 a project was adopted for locks and dams to give 4 feet depth from Trinity, La., to Camden, Ark., but was abandoned two years later. The project under which work continued after 1874 contemplated the removal of snags, logs, wrecks, leaning timber, etc., obstructing navigation below Camden, Ark. The 56 miles known as Black River, below Trinity to Red River, Louisiana, was added to the project in 1884. The amount expended on the original and modified projects prior to operations under the existing project was $614,802.19.

The existing project, besides a continuation of snagging work, contemplates the construction of eight locks and movable dams to afford a navigable depth of 6½ feet from the mouth of Black River, Louisiana, upstream to a point 10 miles above Camden, Ark. (360 miles), as set forth in House Document No. 448, Fifty-seventh Congress, first session (Report Chief of Engineers, 1902, p. 1435). The change of site of Lock and Dam No. 2, referred to in last year's report (Report Chief of Engineers, 1908, p. 490), will eliminate Lock and Dam No. 1 from the project. The latter was adopted in part by provisions of the river and harbor acts of June 13, 1902, and March 3, 1905, authorizing continuing contracts for building Lock and Dam No. 4, near Monroe, La., and Lock and Dam No. 6, near Roland Raft, Ark., completing the survey for locks and dams, and maintenance of prior work. The river and harbor act of March 2, 1907, authorized continuing contracts for the construction of Lock and Dam No. 2, near Catahoula shoals, Louisiana, and Lock and Dam No. 8, near Franklin shoals, Arkansas.

The amount expended under the existing project to June 30, 1909, was $516,802.10 (including $1,750.26 derived from sales). Of this amount $11,786.73 has been applied to completion of survey and $122,471.29 to maintenance.

A contract for building Locks and Dams Nos. 4 and 6, let September 7, 1904, provided for their completion by December 31, 1906, but this time limit was waived. Work commenced October 28, 1904, but abnormally high-river stages limited the time of actual construction to two hundred and ten working days during the fiscal years 1905, 1906, 1907, and 1908. Previous gauge records for fourteen years, from July, 1890, to July, 1904, showed the yearly average working stage (below 10 feet on the Monroe gauge) to be one hundred and forty-one working days. On June 30, 1908, the condition of the work was as follows: On the basis of work done, Lock and Dam No. 4 about 20 per cent completed, Lock and Dam No. 6 about 8 per cent completed. On the basis of work done and material delivered, Lock and Dam No. 4 is about 31 per cent completed, and Lock and Dam No. 6 about 11 per cent completed. Nothing further was done by the contractors, and their contract was terminated by an agreement dated October 22, 1908, under which the contractor's plant, material, and buildings were transferred to the United States. Construction work at Lock No. 4 was undertaken at once by hired labor, but the date on which the contract was terminated, the condition of the plant and cofferdam left by the contractor precluded the hope of accomplishing any important amount of permanent construction during the low-water season of 1908. Barges, machinery, camp buildings, etc., were repaired, and as soon as the necessary plant could be prepared, the work of reenforcing the cofferdam made necessary by scour in the river was commenced and continued during the remainder of the season. Since the termination of the low water in February, 1909, further work was continued in preparing plant, buildings, and material for active operations during the coming low-water period.

Proposals for building Lock 6 were advertised for two months, but only one bid was received, aggregating $213,190.50, upon the estimates of quantities used for canvassing bids. The price bid for concrete work, which is the controlling factor, was considerably in excess of the corresponding unit price in the contract of 1908 for Lock 2 and after reserving from the appropriation the amount necessary for completing Lock 4 without the dam, the balance available was insufficient to cover the cost of the construction contemplated at Lock 6 and the bidder declined to perform a less amount of work at his unit prices. Paragraph 10 of the sundry civil act approved March 4, 1909, rendered funds which it was expected to employ for work at Lock 6 not available, but this difficulty was removed by Congress and information relative thereto furnished the district officer June 28, 1909.

On account of the longer time required for construction of Locks and Dams 4 and 6 than originally estimated, due to the failure of the contractors to complete their contract, together with the scour which has taken place in the river at Lock and Dam No. 4 coincident with this delay, and on account of additions to the original designs thought necessary to secure the work, etc., the amount estimated as required to complete the existing project as far as it refers to these two locks and dams has been increased $439,000.

Proposals for building Lock and Dam No. 2 at Harrisonburg, La., were advertised for two months, and two bids for the work were received; but they exceeded the sum authorized for construction of both lock and dam, and a contract was made August 7, 1908, with the lowest bidder, to build the lock alone at an estimated cost of $296,694.50, exclusive of engineering and contingencies. This contract provides for completion of the lock within two hundred and fifty working days during which natural conditions are such as to permit work inside of the cofferdam. The contractor commenced work promptly and erected camp buildings, assembled plant, and commenced the construction of the cofferdam. The latter work was continued as the river stage permitted until February 6, when the round piling therefor had been driven and the upper line of waling placed with the exception of a 60-foot gap left for the passage of barges. During the remainder of the year the contractor continued preparations for further work during the coming low-water season.

At Lock No. 8 work by hired labor, which was commenced in December, 1907 (see Report for 1908, p. 1570), was continued and the mound, the machine shop, and all camp buildings except an auxiliary cement storehouse at the concrete-mixer platform were completed. On June 30, 1909, the cofferdam, except a gap of 40 feet at the lower outer corner, and excavation for the lock foundation were practically completed. A considerable amount of material for permanent construction, including round and sheet piling, sand and gravel, cement and embedded metal had been procured and further preparations made for proceeding with permanent construction.

During the fiscal year ending June 30, 1909, snagging work for maintenance extended from the mouth of Black River, Louisiana, to Camden, Ark., 350 miles upstream, with greatly beneficial results, and about 5,141 cubic yards of mud and gravel were excavated from the channel at Catahoula shoals, Louisiana, in making a cut 60 feet wide and 450 feet long. This work increased the depth from about 40 inches to near 9 feet.

Besides the slack-water improvement the work heretofore done has consisted chiefly of the removal of snags, logs, wrecks, leaning timber, tree slides, etc., for the purpose of maintaining navigation and the improvement of Catahoula shoals, a rock and gravel bar about 20 miles above Trinity, La., where the available depth at low water was increased from 15 to 40 inches. At moderately high stages, or for six to seven months of the year, New Orleans steamboats ascend the river to Camden, Ark.; at medium stages they run to Monroe, La., but during the periods of low water Harrisonburg, La., 72 miles above Red River, is considered the head of navigation, though small local packets make trips between points on the river above. The maximum draft that can be carried at mean low water is 3½ feet to Harrisonburg, La.; 1½ feet to Monroe, La., and 8 inches to Camden, Ark. The range between high and low water at the several gauge stations on Ouachita River is as follows: Camden, Ark., 44.2 feet; Monroe, La., 48.6 feet; Riverton, La., 51.3 feet, and Jonesville, La., 54.1 feet. Camden, Ark., is considered the head of navigation, but at high stages the river is navigable in fact to Arkadelphia, Ark.

The commerce of Ouachita River and its tributaries is considerable and consists of shipments of cotton, cotton seed, lumber, staves, saw logs, and miscellaneous articles, with return freights of general merchandise and plantation supplies. Most of the cotton is shipped to New Orleans, and large quantities of staves for export are sent to that city. The volume of commerce, as reported for nineteen years, ranges between 73,679 and 313,863 tons per annum, with values estimated at $3,243,200 to $10,234,250. The average is 176,968 tons, valued at $6,220,150. The variations are due to crop yields, the uncertainty of navigation, droughts, and other causes, and the improvement by locks and dams is for an extension of benefits by affording navigation to Camden the year round.

The project has effected a reduction of railroad rates from New Orleans to Monroe, La., and points below to meet the steamboat rates. The territory above Monroe was opened to railroad traffic a few years ago, but the lines as yet have not met the water rates. During periods of navigation the rate on cotton from Monroe to New Orleans is $1.25 per bale, but when navigation is suspended this rate is advanced to $1.75 per bale. Railroad rates from Monroe, La., to inland towns, as a rule, are greatly in excess of those to points where there is water competition.

For more extended information respecting this improvement, reference is invited to the Report of 1895 (p. 1887) and to subsequent reports of the district officers.

An index to reports of examinations and surveys was published in the Report of the Chief of Engineers, 1904, page 389.

The estimated amount of $513,000 that can be profitably expended in the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to continuing construction of locks and dams; to removing obstructions, including snags, overhanging trees, drift, etc.; and to maintaining and operating snag and dredge boats. This additional work is necessary to make the improvement available and for maintenance and the extension of benefits.

The short working season on Ouachita River, the alluvial nature of the river bottom, which requires the use of piling for foundations in lock and dam structures, the necessity of obtaining detailed information as to the character of the underlying material, and the desirability of making tests, plans, and local surveys render it advisable to have funds available for expenditure in preliminary work at lock and dam sites proposed in the general project for improvement other than those for which funds have been provided. Such a provision would expedite the work when funds for construction are provided and would permit of an economical arrangement for labor and plant. It is recommended that $8,000 be provided for these purposes.

July 1, 1908, balance unexpended		$664,245.11
Amount received from sales of property		177.65
Amount appropriated by sundry civil act approved March 4, 1909		176,135.00
Amounts allotted from appropriation by river and harbor act approved March 3, 1909		160,000.00
		1,000,557.76
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$166,286.55	
For constructing snag boat	13,592.18	
For maintenance of improvement	21,664.06	
		201,542.79
July 1, 1909, balance unexpended		799,014.97
July 1, 1909, outstanding liabilities		18,812.52
July 1, 1909, balance available		780,202.45
July 1, 1909, amount covered by uncompleted contracts		302,904.32
Amount (estimated) required for completion of existing project[a]		603,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		513,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix V 3.)

4. Bayou Bartholomew, Boeuf River, Tensas River and Bayou Maçon, and Bayous D'Arbonne and Corney, Louisiana and Arkansas.—These streams are tributaries of Ouachita River and are not navigable at low stages. The works were consolidated by the river and harbor act of June 13, 1902. The improvements are all of the same character, i. e., the removal of snags, wrecks, leaning timber, etc., to lessen the danger and lengthen the period of navigation. Drift, sliding and caving banks, and the rapid growth of vegetation constantly add obstructions.

(*a*) *Bayou Bartholomew, Louisiana and Arkansas.*—Before improvement this stream was navigable for light boats about three months of the year. In 1880 an examination showed that passageway for steamboats was much obstructed.

The project adopted March 3, 1881, contemplated removing obstructions between the mouth and Baxter, Ark., 182 miles.

The amount expended to June 30, 1909, was $66,866.97. The project practically was completed in 1897 to McComb Landing, Ark., the present head of navigation, 141 miles, at a cost of $45,873.53. This work resulted in safer navigation, increased the period to about six months of the year, enabled boats to make trips in half the time formerly required, and reduced freight rates about 50 per cent. There being no demand for navigation above McComb Landing, subsequent expenditures were for maintenance, and $20,993.44 has been applied to that purpose.

Operations for maintenance during the fiscal year ending June 30, 1909, extended from the mouth to Point Pleasant, La., 28.7 miles, and put that part of the stream in fair navigable condition.

---

[a] Estimated cost of completing Locks and Dams Nos. 4 and 6, $439,000, and Locks and Dams Nos. 2 and 8, $164,000.

The commerce consists of shipments of cotton, cotton seed, staves, saw logs, etc., with return freights of general merchandise and plantation supplies. Much of the trade has been diverted to railroads, as the stages of the bayou frequently are not coincident with the needs of transportation. The commerce for nineteen years ranges between a maximum of 49,299 tons in 1891 and a minimum of 1,502 tons in 1907, the average being 12,000 tons, valued at $307,640.

The available funds and the estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, will be applied to removal of snags, overhanging trees, drift, etc., for maintenance.

July 1, 1908, balance unexpended	$2,020.49
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	6,020.49
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,887.46
July 1, 1909, balance unexpended	4,133.03
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*b*) *Boeuf River, Louisiana.*—Before improvement this river was navigable to Point Jefferson, 151 miles, but passage was difficult and dangerous on account of overhanging timber and snags and logs in the channel.

The project adopted March 3, 1881, contemplated removing these obstructions to afford safe navigation at high stages to Wallace Landing, La., about 170 miles above the mouth. Under the river and harbor act of 1886 a supplemental project was entered upon for the closure of three outlets near Point Jefferson to confine the flow to the main channel.

The total expenditure to June 30, 1909, was $68,243.53. The original project was completed in 1896 at a cost of $40,992.84. Since then $21,808.91 (including $27.75 received from sales) has been expended for maintenance. In 1887–88, by uniting with planters whose lands would be protected from overflow, the outlets near Point Jefferson were closed by earthen dams, the proportion of the cost borne by the United States having been $5,441.78.

The work put the stream in safe navigable condition at stages high enough to permit steamboats to cross the bars and, when completed, enabled them to save thirty-six hours' time on a trip.

The closure of the outlets gave immediate benefit to navigation by concentrating the flow to the main stream, lengthening the period of navigation, and causing the bars to scour. The dams, however, were destroyed in 1890, during an overflow from Mississippi River, caused by crevasses in the levees near the headwaters of Boeuf River, and funds for their restoration have not been provided.

During the fiscal year ending June 30, 1909, snagging work and the removal of leaning trees, etc., extended from the mouth upstream to

---

[a] See consolidated money statement on page 523.

Point Jefferson, La., 150.8 miles, and the chief obstructions of this character were destroyed for the time.

The commerce consists of shipments of cotton, cotton seed, staves, etc., and return freights of general merchandise and plantation supplies, and for nineteen years ranges between a maximum of 11,261 tons in 1897 and a minimum of 545 tons in 1903, the average being 5,459 tons, valued at $232,400.

The available funds and the additional amount estimated for the fiscal year 1911 will be applied to maintenance by the removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for extension of benefits.

Navigation is rendered more difficult on account of the outlets at Point Jefferson, and additional interest in the project for again closing them is maintained through the necessity of draining Bayou Lafourche Basin, into which the outlets flow, to permit development of a rich tract of land containing 220,800 acres, much of which has been converted into a swamp and all of which is seriously affected by flood water from Boeuf River.

July 1, 1908, balance unexpended	$5,518.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
Amount received from sales of property	27.75
	9,546.34
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,362.12
July 1, 1909, balance unexpended	6,184.22
July 1, 1909, outstanding liabilities	145.90
July 1, 1909, balance available	6,038.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

(*c*) *Tensas River and Bayou Maçon.*—Before improvement these streams were navigable at high stages, but the passage of steamboats was difficult and dangerous on account of leaning timber and numerous snags, logs, stumps, etc., in the channel.

The project adopted March 3, 1881, contemplated removing obstructions in Tensas River from its mouth to Dallas, La., 138 miles. Bayou Maçon, the chief commercial branch of Tensas River, was added under the same head of appropriation by river and harbor act of 1884, and the project contemplated the same kind of work from its mouth to Floyd, La., 112 miles.

The total expenditures to June 30, 1909, were $58,527.75. The project for Tensas River was completed in 1898 to Westwood Place, 81 miles above the mouth, the present head of navigation, at a cost of $11,947.02, and the project for Bayou Maçon to Floyd was completed in 1899 at a cost of $23,915.42. Lane Ferry, about 20 miles above Floyd, is the head of navigation in Bayou Maçon. The sum of $22,665.31, including $27.75 derived from sales, has been expended for maintenance. The work put the two streams in fairly good navigable condition at medium and high stages. Upper Tensas River above Westwood Place practically is unnavigable by reason of leaning timber and obstructions in the channel, and there has been no recent effort to induce a resettlement of the abandoned plantations along its banks or to secure a continuance of the improvement to Dallas.

---

[a] See consolidated money statement on page 523.

During the fiscal year ending June 30, 1909, work for maintenance was continued and consisted of the removal of snags, leaning trees, etc., obstructing navigation of Tensas River between Westwood Place and its mouth. No work was performed in Bayou Maçon.

The commerce consists chiefly of shipments of cotton, cotton seed, staves, etc., and return freights of plantation supplies. In nineteen years it has ranged between a maximum of 29,957 tons in 1905 and a minimum of 2,649 tons in 1893, the average being 15,187 tons, valued at $612,340.

It is proposed to apply the available funds to maintenance, and the additional estimate for the fiscal year 1911 to the removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for maintenance and extension of benefits.

July 1, 1908, balance unexpended	$3,912.99
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
Amount received from sales of property	27.75
	8,940.74
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,940.74
July 1, 1909, balance unexpended	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*d*) *Bayous D'Arbonne and Corney, Louisiana.*—Before improvement navigation of these streams was difficult and dangerous on account of the leaning trees and the number of snags, stumps, etc., in the channel.

The project adopted July 5, 1884, contemplated removing the obstructions between the mouth of Bayou D'Arbonne and Stein Bluff on Bayou Corney, 40½ miles upstream. The river and harbor act of 1892 authorized an extension of work up Bayou Corney 16½ miles to Cobb Landing, and the act of 1894 provided $1,000 for removing obstructions in the Little D'Arbonne Branch.

The amount expended to June 30, 1909, was $23,974.95, and resulted in greater safety to navigation. The work practically was completed in 1896 at a cost of $18,000. Subsequent expenditures for maintenance have amounted to $4,974.95, and $1,000 was expended for improving Little D'Arbonne Branch.

No work was done during the fiscal year ending June 30, 1909, as the stages were not favorable since the allotment was made for its continuance.

The commerce consists of shipments of cotton, cotton seed, etc., and return freights of plantation supplies. It varies considerably,

---

[a] See consolidated money statement on page 523.

and during thirteen years ranged between a maximum of 36,272 tons in 1907 and a minimum of 682 tons in 1903, the average being 11,369 tons, valued at $317,420.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, and the balance unexpended July 1, 1909, will be applied to removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for maintenance and extension of benefits.

July 1, 1908, balance unexpended	$125.05
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
July 1, 1909, balance unexpended	2,125.05
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

A condensed history of the work performed in Bayou Bartholomew, Boeuf River, and Tensas River and Bayou Maçon will be found in the Report of the Chief of Engineers for 1896, pages 1601–1613, and of that performed in Bayous D'Arbonne and Corney in the Report of 1895, page 1914. Subsequent reports of the district officers refer only to the yearly operations.

An index to reports of examinations and surveys was published in the Report of the Chief of Engineers for 1904, page 391.

There is no record of freight rates on Bayou Bartholomew and works consolidated with it available for making a comparison of the effect of the improvement. In a general way it may be stated that the rates have been greatly reduced; in fact, the traffic is no longer sufficiently lucrative to support the class of boats formerly plying on this stream, but it is now carried by smaller boats. This is largely due, however, to the competition by the railroads, and now boats ply only where the river is the only shipping route.

CONSOLIDATED.

July 1, 1908, balance unexpended	$11,577.12
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
Amount received from sales of property	55.50
	26,632.62
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	9,190.32
July 1, 1909, balance unexpended	17,442.30
July 1, 1909, outstanding liabilities	145.90
July 1, 1909, balance available	17,296.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	16,000.00

(See Appendix V 4.)

---

[a] See consolidated money statement on this page.

5. *Mouth of Yazoo River and harbor at Vicksburg, Miss.*—The shifting bar at the former mouth of the Yazoo was the most serious obstruction to navigation of that river and its tributaries, a system comprising about 800 miles of navigable waterways. At low stages steamboats were prevented from entering or leaving the river without lightering their cargoes across the bar, and it frequently happened that the outlet was entirely closed to navigation throughout the busiest season of the year.

Prior to 1876 the city of Vicksburg possessed the most commanding site and the finest harbor on the Mississippi River. There was deep water along the city front, and the entire width of the river was available for steamboats at all stages, with not less than 25 feet depth in any part of the harbor. The cut-off of April 27, 1876, and subsequent shoaling of the old channel from the river to the front of the city, practically destroyed the harbor, which became unnavigable except at high stages.

The original project for improving Vicksburg Harbor was entered upon under the river and harbor act of June 18, 1878. The first work consisted of revetting the rapidly caving bank at Delta Point, La., opposite Vicksburg, the continued recession of which was increasing the distance from the harbor to the river channel. The river and harbor act of August 2, 1882, placed the work under the Mississippi River Commission, and the revetment at Delta Point was continued until 1900. No work has been done since. Some caving has occurred above the upper end of the revetment, which is protected by a hard point, but there appears to be no immediate danger of flanking. The amount expended at Delta Point was $389,486.08.

When Vicksburg Harbor was placed under the Mississippi River Commission in 1882, a project was adopted for dredging a basin 1,700 feet long by 300 feet wide in front of the city, with a canal 150 feet wide to connect it with the river. Dredging under this project amounted to 250,035 cubic yards in 1883, when discontinued. It was resumed in 1888, under a slightly modified project, and continued until 1893. During the latter period the dredging amounted to 1,729,994 cubic yards, making a total of 2,080,029 cubic yards of excavation. In 1888 pile dikes were built at the north end of the basin and along the west side of the canal, aggregating 6,800 feet in length. The expenditures for Vicksburg Harbor were $442,724.77, which, added to the amount expended at Delta Point, makes a total of $832,210.85. The improvement of Vicksburg Harbor was transferred to the Engineer Department under a provision of the river and harbor act of August 18, 1894.

The existing project, adopted by Congress in the river and harbor act of July 13, 1892, contemplated opening a new mouth or outlet for Yazoo River from its original mouth on Old River (9.8 miles above the former outlet to the Mississippi) through deep water down the wrong end of Old River, thence across a neck of low land between Old River and Lake Centennial and around the head of De Soto Island and down the east arm of Lake Centennial to the Mississippi River, entering it upon the channel side at Kleinston Landing.

Lake Centennial is the old bend of the Mississippi River cut-off in 1876, and De Soto Island, prior to the cut-off, was the Louisiana peninsula, around which the river flowed. The estimate of cost—$1,500,000—was revised in 1893 and reduced to $1,200,000.

The work was completed in 1905 at a cost of $1,179,210.87. Subsequent expenditures for maintenance amount to $34,788.58. The new outlet was opened in the spring of 1903; uninterrupted navigation of Vicksburg Harbor has been maintained for six years, and the new mouth of Yazoo River has been open to boats of 6 feet draft at mean low water. The extreme range between high and low water at Vicksburg is 59 feet, but the usual variation is about 45.3 feet.

The chief features of this work were the purchase of 1,155.54 acres of land for right of way of the main cut from Old River to Lake Centennial; the clearing and grubbing of the entire route; the excavation by dredging of 6,229,281 cubic yards of earth in opening the new outlet, of which about 934,000 cubic yards was used for building a dam, above ordinary low water, across the west arm of Lake Centennial from mouth of the main cut to head of De Soto Island, and constructing a levee containing 429,677 cubic yards from mouth of the canal at Kleinston westward along West Pass bar (which separates the west arm of Lake Centennial from Mississippi River) to within about 4,500 feet of King Point.

The work performed during the fiscal year ending June 30, 1909, was for maintenance, principally for repairs and protection of the West Pass levee. Expenditures of $40,000 for revetment of West Pass levee on the lake side, to protect it from wave wash, and to replace decaying wooden bulkheads, and $4,000 for surveys, were authorized and allotments for the purposes were made under section 1 of the river and harbor act of March 3, 1909. The revetment was partially built in April and May, 1909, 1,194 squares having been paved. It will be completed during the fiscal year 1910, and the surveys will be made during the period of low water.

The annual commerce of Yazoo River, its tributaries, and Vicksburg Harbor, as reported for seven years, varied between 222,792 and 441,765 tons, the estimated values of which ranged from $6,801,000 to $13,272,000 per annum. The average of the commerce was 321,594 tons per annum, and the average value $8,753,650.

Maps of the work at Delta Point have been published in Annual Reports of the Chief of Engineers for 1883, 1884, 1888, 1889, 1893, and 1900. Maps of Vicksburg Harbor accompany the reports of 1878 (p. 644), 1883, 1884, 1888, 1890, and 1893. Maps showing work under the existing project for diverting the mouth of Yazoo River, etc., accompany the reports of 1893, 1894, 1901, and 1902. Fifteen photographs were printed in the report for 1900.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, will be applied to maintenance by dredging in Old River.

July 1, 1908, balance unexpended	$7,844.71
Amount allotted from appropriation by river and harbor act approved March 3, 1909	44,000.00
	51,844.71
June 30, 1909, amount expended during fiscal year for maintenance of improvement	21,844.16
July 1, 1909, balance unexpended	30,000.55
July 1, 1909, outstanding liabilities	402.31
July 1, 1909, balance available	29,598.24
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	8,000.00

(See Appendix V 5.)

6. *Yazoo, Tallahatchie, Coldwater, and Big Sunflower rivers, and Tchula Lake, Mississippi.*—These improvements were consolidated by river and harbor act of June 13, 1902. The same kind of work is required in all, i. e., the removal of wrecks, snags, stumps, tree slides, sunken logs, leaning timber, etc., for maintenance of navigation.

(*a*) *Yazoo River.*—Before improvement the period of navigation was limited to high stages on which steamboats could pass the wrecks of gunboats, steamers, and raft sunk during the civil war. The channel was much obstructed also by snags, stumps, tree slides, leaning timber, etc.

The project entered upon March 3, 1873, contemplated removing obstructions to give ease and safety to navigation. Subsequent acts of Congress provided for continuing the improvement and for maintenance. There is no practical distinction between improvement and maintenance, as floods, sliding and caving banks, and the rapid growth of vegetation along alluvial streams of this kind constantly add obstructions and render a continuance of snagging operations necessary in the interest of safe and uninterrupted navigation.

The total expenditure to June 30, 1909 (including $203.26 derived from sales), was $404,508.94, which has resulted in safe and uninterrupted navigation from mouth to head of the river the year round for more than twenty-five years. Steamboats of 3½ feet draft navigate the river at mean low water without serious difficulty.

During the fiscal year ending June 30, 1909, snagging operations, etc., for maintenance, extended over the entire river.

The range between high and low water at Yazoo City is 40.8 feet. It is proposed to apply the available funds to continuing work for maintenance of the improvement.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

July 1, 1908, balance unexpended		$65,059.18
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
Amount received from sales of property		92.80
		75,151.98
June 30, 1909, amount expended during fiscal year:		
For constructing snag boat	$12,363.17	
For maintenance of improvement	20,094.49	
Amount transferred to Tallahatchie and Coldwater rivers	1,500.00	
		33,957.66
July 1, 1909, balance unexpended		41,194.32
July 1, 1909, outstanding liabilities		813.92
July 1, 1909, balance available		40,380.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		[a]
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*b*) *Tallahatchie and Coldwater rivers.*—Before improvement Tallahatchie River was navigable to Sharkey, about 65 miles above its mouth, for six months of the year, but passage was difficult and dangerous on account of the number of obstructions in the channel and along the banks, and the wreck of the ocean steamship *Star of the West*, sunk February, 1863, 8 miles above the mouth. Above Sharkey the growth of leaning timber was so dense and the channel so obstructed by snags, etc., that that part of the stream practically was unnavigable. The same conditions continued up the Coldwater River.

The project entered upon March 3, 1879, contemplated removing obstructions in Tallahatchie River from the head of Yazoo River to the mouth of Coldwater River and up the Coldwater about 80 miles to Yazoo Pass. Work in the Coldwater River was abandoned in 1881, but was resumed under a provision of the river and harbor act of March 3, 1905.

The amount expended to June 30, 1909 (including $40 derived from sales), was $84,031.36, and the work performed permits steamboats of 3 feet draft to run to Sharkey the year round and into Coldwater River at moderately high stages.

Marks, on Coldwater River, is considered the present head of navigation, and boats rarely run above that place.

During the fiscal year ending June 30, 1909, work for the removal of obstructions in Tallahatchie River was continued between Minter City and Yazoo River, 68½ miles, benefitting navigation materially.

Work in Coldwater River extended from its mouth upstream to Yazoo Pass, but was not thorough on account of interruptions and unfavorable conditions caused by high stages.

Operations for maintenance will be continued with the available funds.

---

[a] See consolidated money statement on page 531.

The estimated amount that can be profitably expended during the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

July 1, 1908, balance unexpended	$2,411.89
Amount transferred from allotment for Yazoo River	1,500.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
Amount received from sales of property	40.00
	13,951.89
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,943.25
July 1, 1909, balance unexpended	9,008.64
July 1, 1909, outstanding liabilities	1,127.85
July 1, 1909, balance available	7,880.79
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*c*) *Tallahatchie River above mouth of Coldwater River to Batesville.*—To comply with requirements of river and harbor acts of 1880, 1881, and 1882, a total expenditure of $10,000 was made to clear this stretch of obstructing trees, stumps, and snags, after which work was discontinued by the United States. Commerce was revived in 1904, and, after the worst obstructions had been removed by popular subscription, about 2,100 tons of stave and spoke billets and other freight, valued at $100,000, was transported by steamboat.

The project entered upon March 2, 1907, contemplated an expenditure of $2,000 a year for a series of years to put the river in such condition that boats plying the lower Tallahatchie can safely run to Batesville for five to seven months of the year, eventually the cost of maintenance to be reduced to $1,000 per year.

The total amount expended to June 30, 1909, was $13,824.89. The work was resumed in May, 1907, after a lapse of twenty-five years, and was continued downstream to the mouth of Coldwater River. The chief obstructions to navigation were removed and the stretch placed in fairly good navigable condition. The cost of this maintenance was $3,824.89; and the work proved heavier and more difficult than was anticipated.

No work was performed during the fiscal year 1909 for lack of funds during the period of low water.

The recent allotment and the estimated amount that can be profitably expended during the fiscal year ending June 30, 1911, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

---

[a] See consolidated money statement on page 531.

July 1, 1908, balance unexpended	$175.11
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
July 1, 1909, balance unexpended	5,175.11
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor of 1899.	

(*d*) *Big Sunflower River.*—Before improvement this stream was navigable about six months of the year, but was obstructed by snags, sunken logs, sand bars, and shoals; navigation was impeded by leaning timber, and at many places the channel was so choked with obstructions and so narrow that it afforded passage for the smallest craft only.

The project entered upon March 3, 1879, contemplated the removal of obstructions between the mouth and Clarksdale, about 180 miles, and the building of inexpensive pile and brush wing dams to scour depths of about 40 inches at the bars. Prior to the building of the Mississippi River levees, and since, when crevasses in the levees occurred, this stream carried large quantities of overflow water and its section was increased thereby. In this enlarged bed the normal river at low stages now flows between secondary banks and, as a rule, the main banks are not overtopped by floods, except near the mouth, where the flood height is affected by backwater from the Mississippi.

On account of the changed conditions, the river and harbor act of March 2, 1907, placed the upper limit of improvement at the mouth of Hushpuckena River, about 30 miles below Clarksdale; authorized a continuation of the work of removing obstructions below that point, and an improvement of the lower section, below Baird, about 87 miles, with a view to obtaining a navigable depth of 3 feet by means of the closure of outlets and more extensive contraction works. The estimates of cost for work below Baird were $75,000 for the necessary closing dams, about $10,000 per year for five years for continuation of the open-river work, and $5,000 per year thereafter.

The amount expended to June 30, 1909, was $166,375.20. The cutting of leaning timber, removal of channel obstructions, and the building and renewal of wing dams at the bars maintained navigation in the lower 100 miles of river, and enabled boats of 30 inches draft to run to Woodburn, about 77 miles above the mouth, at mean low water. Faisonia, about 100 miles above the mouth, is considered the head of navigation. A contract was entered into November 12, 1907, for closing the chutes in lower Big Sunflower River, requiring 118,755 cubic yards of levee embankment, and the work has now been completed.

During the fiscal year ending June 30, 1909, operations for maintenance continued during the period of low water, between the mouth of Big Sunflower River and a point 4 miles above Baird, and consisted of the removal of snags, leaning timber, etc., obstructing navigation and the construction and repair of wing dams at shoal places.

The contract for closing the chutes in lower Big Sunflower River was completed February 20, 1909.

---

[a] See consolidated money statement on page 531.

It is proposed to apply the available funds and the additional appropriation recommended to a continuance of snagging operations and the building and repair of wing dams where required.

July 1, 1908, balance unexpended	$85,478.68
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	48,853.88
July 1, 1909, balance unexpended	36,624.80
July 1, 1909, outstanding liabilities	1,582.17
July 1, 1909, balance available	35,042.63
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

(*e*) *Tchula Lake.*—This is an arm of Yazoo River, about 60 miles long, and east of Honey Island, in Holmes County. Before improvement it was obstructed its entire length by a network of snags, heavy leaning timber, and a thick growth of brush along both banks.

The project adopted March 3, 1881, contemplated removal of the obstructions to prolong the navigable period and to permit light-draft steamboats to pass through the lake earlier in the cotton season.

The amount expended to June 30, 1909, was $31,962.09. The work was practically completed and the stream put in safe navigable condition in 1895 at an expenditure of $21,000. Since 1902 $10,962.09 has been expended for maintenance.

During the fiscal year ending June 30, 1909, work for maintenance extended from the head of the lake downstream about 35 miles to near Black Bayou, and consisted of the removal of snags, leaning trees, etc., obstructing navigation.

The available funds will be applied to continuing work for maintenance.

The estimated amount that can be profitably expended during the fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

July 1, 1908, balance unexpended	$4,290.65
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	9,290.65
June 30, 1909, amount expended during fiscal year for maintenance of improvement	3,252.74
July 1, 1909, balance unexpended	6,037.91
July 1, 1909, outstanding liabilities	80.00
July 1, 1909, balance available	5,957.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

---

[a] See consolidated money statement on page 531.

The chief shipments of Yazoo River and tributaries are cotton, cotton seed, staves, timber, etc., with return freights of general merchandise and plantation supplies. The commerce of eighteen years ranges between 102,098 and 544,503 tons annually, with values estimated at $2,840,000 to $9,198,000, the average being 241,573 tons, valued at $5,590,330.

Freight rates on cotton by boat are about 50 per cent less than by rail; on cotton seed about 33⅓ per cent less. Live-stock shipments by boat cost about one-third of the railroad rates, and grain, flour, meal, and provisions shipped by boat cost about 50 per cent less than by rail. To inland points the railroad rates are largely in excess of boat rates for the same distance. Large quantities of timber are rafted which could not be reached by rail.

A résumé of the work performed in Yazoo, Tallahatchie, and Big Sunflower rivers is given in the Report of the Chief of Engineers for 1896, pages 1613, 1626, and 1630. A résumé of work in Coldwater River is given in the Report of the Chief of Engineers for 1885, page 1518. Subsequent annual reports of the district officers give each year's operations only.

An index to reports of examinations and surveys was published in the Report of the Chief of Engineers for 1904, page 397. Reports of examinations of Tallahatchie River above mouth of Coldwater to Batesville, and of Big Sunflower River, made in 1905, were printed in House Documents Nos. 147 and 667, Fifty-ninth Congress, first session. Reports of an examination and survey of Big Sunflower River from near Baird to mouth of Hushpuckena River, made in 1907 and 1908, were printed in House Document No. 1251, Sixtieth Congress, second session.

CONSOLIDATED.

July 1, 1908, balance unexpended		$157,415.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909		30,000.00
Amount received from sales of property		132.80
		187,548.31
June 30, 1909, amount expended during fiscal year:		
For constructing snag boat	$12,363.17	
For maintenance of improvement	77,146.36	
		89,507.53
July 1, 1909, balance unexpended		98,040.78
July 1, 1909, outstanding liabilities		3,603.94
July 1, 1909, balance available		94,436.84
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		57,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix V 6.)

7. *Removing sunken vessels or craft obstructing or endangering navigation.*—During the fiscal year the wreck of the steamer *J. A. Townes* was removed from Yazoo River at a cost of $118.86. The cost of the work was afterwards paid by the owners of the vessel and the amount received, $118.86, was deposited in the Treasury to the credit of miscellaneous receipts.

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated October 16, 1907, and October 20, 1908, respectively, on preliminary examination and survey of *Big Sunflower River, Mississippi, from near Baird to the mouth of the Hushpuckena River,* etc., required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1251, Sixtieth Congress, second session. The locality is not considered worthy of improvement at the present time in the manner proposed.

IMPROVEMENT OF RIVERS AND HARBORS IN THE LITTLE ROCK, ARKANSAS, DISTRICT.

This district was in the charge of Capt. W. D. Connor, Corps of Engineers, to October 31, 1908; of Capt. G. R. Lukesh, Corps of Engineers, from October 31, to December 7, 1908; and of Maj. M. L. Walker, Corps of Engineers, since the latter date. Division engineer, Col. W. H. Bixby, Corps of Engineers.

1. Arkansas River, Arkansas.—In its original condition the channel of the river was greatly obstructed by shifting sand bars and numerous snags in its lower reaches, and by gravel and rock shoals and some snags in its upper reaches. Navigation was difficult and uncertain at medium and low stages, and during periods of extreme low water was impossible.

Prior to act of Congress approved June 13, 1902, the work on this river was carried on under two general projects—one entitled "Removing obstructions in Arkansas River, Arkansas and Kansas," the other "Improving Arkansas River, Arkansas."

The original project for "Removing obstructions in Arkansas River, Arkansas and Kansas" (act July 3, 1832), was to remove snags and wrecks. Subsequently this project was enlarged to include removing bars by wing dams, and many of the appropriations were made for this work in combination with other rivers. By act of March 3, 1879, Congress adopted an additional project—that of improving the river between Fort Smith, Ark., and Wichita, Kans., by removing the snags and rocks and constructing dams at some of the worst shoals. Later these projects were merged into one, making the project extend from the mouth of the river to Wichita. Under these projects there was expended to June 30, 1902, $968,256.81.

The original projects for "Improving Arkansas River, Arkansas," were local and had in view the permanent improvement of the river at Fort Smith, Van Buren, Dardanelle, and Pine Bluff. By act of August 11, 1888, Congress adopted a general project, namely:

> That the Secretary of War shall expend the appropriation under this head with reference to the final improvement of this river as contemplated in the Report of the Chief of Engineers for the year ending July first, eighteen hundred and eighty-five, and as authorized in the act for the improvement of rivers and harbors approved August fifth, eighteen hundred and eighty-six, and in House Executive Document Numbered Ninety, Forty-ninth Congress, first session; said methods to be applied as the Secretary of War may direct at such points between Wichita, Kansas, and the navigable mouth of the Arkansas River at its junction with the Mississippi River, as he may deem for the best interest of commerce.

The "said methods" referred to in the act were "to remove rock and gravel reefs by blasting and dredging, to contract the channel by dikes and dams, permeable or solid, of such construction as the local conditions require, and to hold the channel so obtained by revetment where necessary." The improvement authorized by the act covers 771 miles, while estimates have been rendered for 708 miles, thus making the estimated cost of the improvement under this project indefinite. Act of August 18, 1894, authorized the operation of snag boats under this head in addition to similar operations under the project "Removing obstructions in Arkansas River, Arkansas and Kansas." To the close of the fiscal year ending June 30, 1902, there had been expended under the general project for improving Arkansas River, Arkansas, $903,311.93 for original construction, $314,119.14 for maintenance, and $63,397.32 for operating snag boats, making the total amount $1,280,828.39.

Act of Congress approved June 13, 1902, merged these two general projects into one, which makes the existing project in substance: "The improvement of the river from its mouth to the head of navigation by snagging operations, by dredging operations, and by contraction works, holding the improved channel by revetment where necessary." No definite estimate of cost can be given.

The river and harbor act of March 2, 1907, made available for maintenance of this improvement amounts previously appropriated for work in vicinity of Redfork levee or set apart for dredging. The act provided also for an examination of the river to Muskogee, Ind. T., by a Board of Engineers, with a view to devising a plan for further improvement, and made a conditional appropriation for work at Pine Bluff, if deemed by the Board to be necessary in the interest of navigation. Funds from this appropriation were applied to work in pursuance of the Board's recommendation, and report on the subject will be found on pages 538 and 539 of this report under the heading "Arkansas River at Pine Bluff and White River at Augusta Narrows, Arkansas."

To June 30, 1909, there had been expended under the consolidated project for Arkansas River $227,795.57, of which $169,204.29 was for operating snag boats, $38,121.28 for operating a hydraulic dredge, and $20,470 for maintaining works of permanent improvement. The total expenditures under all projects to June 30, 1909, is $2,476,880.77, of which $1,200,858.42 is for operating snag boats, $38,121.28 is for operating a hydraulic dredge, $903,311.93 for original construction of works of permanent improvement, and $334,589.14 for maintenance of those works. Other expenditures on this river are shown in this report under the headings "Arkansas River at Pine Bluff and White River at Augusta Narrows," page 538 of this report, and "Arkansas River at Pine Bluff," page 539 of this report. After expending $1,237,901.07 in the construction and maintenance of works, the permanent improvement of the stream was abandoned before completing the project. Snagging operations have improved the channel in the permanent reaches; in other localities the improvement has been temporary and must be repeated from time to time.

Fort Gibson, on Grand River, 2 miles above its mouth and 463 miles from the mouth of the Arkansas River, is the head of steamboat navigation. The duration of the navigable periods of the river varies greatly in different years. Occasionally there are periods of very low water, when navigation will be suspended throughout the length of river, and then there will be times when it is possible to maintain 3-foot navigation through to Fort Gibson all the year. Generally the maximum draft that can be carried at ordinary low water is 3 feet from the mouth of the river to Pendleton (42); 2 feet from Pendleton (42) to Swan Lake (80); 1½ feet from Swan Lake (80) to Webbers Falls (430); and 1 foot from Webbers Falls (430) to mouth of Grand River (461). The periods of navigation by steamboats are of about the following averages:

	Months a year for 4-foot draft.	Months a year for 2-foot draft.
Mouth to Swan Lake (80 miles)	5½	10
Mouth to Little Rock (174 miles)	5	9½
Mouth to Grand River (461 miles)	4	8

The range between extreme high water and extreme low water at Fort Smith, Ark., is 35.5 feet; at Little Rock, Ark., 28.5 feet; and at the mouth of the river where the stages are controlled by those of the Mississippi the extreme range is 53.7 feet.

The operations of this fiscal year consisted in snagging operations, and in dredging operations with a hydraulic dredge borrowed from the Mississippi River Commission. The snag boats *Arkansas* and *C. B. Reese* operated below Spadra (290), removing 2,217 snags from the channel, cutting 22,038 trees on caving banks, and breaking up 9 drifts. A chopping party working between Fort Smith (369) and mouth of Grand River (461) removed 912 snags, cut 320 trees, and destroyed 35 drift piles. The hydraulic dredge *Gamma* was operated at three localities, but the principal work was done at Rob Roy (99). Here the main channel of the river had left the draw spans of the railway bridge and only a secondary channel behind a middle bar afforded a passage for boats through the draw openings of the bridge. The dredge opened this secondary channel, and notwithstanding this unfavorable condition the dredged channel has remained open to the close of this fiscal year, but for fifteen days (October 10–24) during the lowest water period of this fiscal year the dredged cut did not afford a navigable channel. The dredged cuts made at the other two localities were obliterated in the freshet of October 25–November 3, 1908. Because of having to return the borrowed dredge to the Mississippi River Commission about the 1st of August each year there has been no opportunity in the two seasons it has been operated in this river to fully try out its work during low-water periods; but judging from such dredging as has been done it appears that by such operations much material aid can be given to navigation by lengthening the navigable periods of the river. The district officer recommends that two dredges be provided for the river below Little Rock, 174 miles.

The Muskogee-Oklahoma Packet Company, which was organized for the purpose of operating a boat line between Fort Smith and Muskogee, built a boat but did no business during the year. The Little Rock Packet Company has been organized for the purpose of operating a boat line out of Little Rock. It has purchased two boats. The Arkansas River Packet Company became bankrupt during the year and the Memphis and Pine Bluff Packet Company has taken its place.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1894	63,563	$2,846,395	1902	40,557	$1,630,297
1895	50,498	2,380,420	1903	86,068	2,389,020
1896	54,261	2,408,720	1904	92,041	2,078,893
1897	66,077	1,657,218	1905	86,458	1,636,930
1898	58,578	1,626,756	1906	103,214	1,512,719
1899	68,057	2,470,131	1907	104.593	2,192,531
1900	75,654	2,078,940	1908	103.919	2,150,269
1901	71,998	2,623,797	1909	92,455	2,122,105

Rafted saw logs floated with the current made up 60 per cent of the commerce reported and represent 6 per cent of the estimated value. Plantation products and supplies and timber products made up the steamboat commerce. It does not appear that the improvement of the river in late years has had any marked effect on intrastate freight rates, either by water or by rail. In 1900 and 1901 the improvement of the river reached its highest state of development. Since that time the permanent works have been permitted to deteriorate, and the snag boats working alone have not been able to extend the development any. The intrastate rail rates are controlled by a state railway commission and are based on a "standard distance tariff," and the river is not taken into consideration in making this tariff. This statement applies to all the rivers in the State of Arkansas.

The balance available July 1, 1909, will be expended in snagging operations. The amount estimated for the fiscal year June 30, 1911, is for snagging operations, procuring additional plant, and maintaining permanent works at Pine Bluff. The "additional plant" referred to is a small snag boat to cost $30,000 for use in the upper Arkansas, but for reasons stated by the district officer this expenditure can be postponed until a further need of the boat is shown. The district officer states that there is a permanent need for a revetment plant on this river for use in maintaining works already built as well as for use in preventing cut-offs. He makes no estimate of the cost of a suitable plant, presumably withholding such estimate until Congress takes some action upon the reports of the several preliminary examinations that have been ordered for this river.

References to the principal examinations and surveys of this river are given on page 401 of the Annual Report for 1904.

July 1, 1908, balance unexpended	$53,397.85
Receipts from sales	9.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	35,000.00
	88,406.85
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	[a] 48,970.05
July 1, 1909, balance unexpended	39,436.80
July 1, 1909, outstanding liabilities	8,620.43
July 1, 1909, balance available	30,816.37

---

[a] Snagging $33,805.34; dredging, $15,164.71.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a] $81,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix W 1.)

2. White River, Arkansas.—In its original condition this river was much choked by logs, snags, and drift in its lower reaches, and in its upper reaches—i. e., above Jacksonport—by gravel shoals, bowlders, and some snags.

The original project (act of March 3, 1871) was to remove snags and similar obstructions, the work being combined with similar work on Black and Little Red rivers. Act of June 23, 1874, extended the improvement to Forsyth, Mo., the project being to remove snags and bowlders and to contract the water width at shoals. During the period 1873–1884 the snagging operations on the lower river were in connection with similar work on St. Francis River, while the improvement above Jacksonport was under appropriations confined to that portion of the stream. The act of July 5, 1884, was the first independent appropriation for the river as a whole. It readopted and consolidated into one the separate projects and provided for a survey with a view to the permanent improvement of the river from Forsyth, Mo., to the mouth. The project of 1888 (Annual Report of the Chief of Engineers for 1888, p. 1406) was to deepen the water on shoals by contracting the channel, and to remove rocks, bowlders, and snags from the channel, the object being to obtain a channel 5 feet deep at low water from the mouth to Newport and 2 feet deep thence to Buffalo shoals, at an estimated cost of $105,815, with an additional amount of $8,000 a year for two or three years for snagging. For reasons given in the Annual Report of the Chief of Engineers for 1891, page 2049, the estimates were inadequate to accomplish the object. The act of July 13, 1892, appropriated $53,815 to complete the project, and an additional sum of $21,185 to be expended "in the discretion of the Secretary of War." These funds and those appropriated since have been expended on the lines of the project of 1888, with the addition of dredging on the shoals. The act of March 3, 1899, adopted a lock-and-dam project for the improvement of this river above Batesville, thus reducing the scope of the former project to improving the river from the mouth to Batesville by contracting the channel, by removing rocks, bowlders, and snags, and by dredging.

It is not practicable to state the expenditures on this river when the work was carried on in connection with other rivers. From the separate appropriations for the whole river, or for reaches of it, to the close of the fiscal year ending June 30, 1909, there had been expended $448,003.13. Of this amount $362,801.57 had been expended on projects prior to March 3, 1899, and $85,201.56 had been expended on maintenance of channel below Batesville.

In a few instances the contraction works above Jacksonport gave a slight increase in channel depth, but on the whole there was not enough improvement in the channel to be of any material benefit to navigation; the dredging between Jacksonport and Batesville in fiscal year 1898 made a channel 3 feet deep during one low-water season, but the dredging has not been continued, no plant being available; the snagging operations make the natural depths of the stream available during the low-water season in which the snagging is done. The winter and the spring floods following bring other obstructions into the stream; hence snagging operations are needed every year.

---

[a] This amount may be reduced by $30,000 for reasons given in text above and in Appendix W 1.

Forsyth, Mo. (505 miles above the mouth), is the head of steamboat navigation. From its mouth to Jacksonport, 264 miles, the river is generally spoken of as being navigable at any time for boats of not over 3-foot draft. Between Jacksonport and Batesville, where Lock No. 1 of the upper White River improvement is located, the low-water channel depths are approximately 16 inches.

The range between extreme high water and extreme low water below Dam No. 1 at Batesville is 35.5 feet; at Jacksonport, 34.4 feet; at Clarendon, 32.5 feet; and at the mouth of the river 53.7 feet.

On page 1668 of the Annual Report of the Chief of Engineers for 1896 there is given the location of all the principal works built for the improvement of this river. Report of survey from Forsyth, Mo., to the mouth, with plans for improvement, is given in the Annual Report of the Chief of Engineers for 1888, page 1406.

The snagging operations this fiscal year consisted in operating the snag boat *Quapaw* three and one-half months and the snag boat *C. B. Reese* one and a half months between the mouth of the river and Lock No. 1, near Batesville, Ark. By these operations 771 snags were removed, 30 drifts broken, and 2,826 trees cut.

The balance available July 1, 1909, and the amount estimated as being needed during the fiscal year ending June 30, 1911, will be applied to maintenance and operation of snag boats.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	73,759	$2,494,377	1903	140,013	$882,225
1896	74,882	2,056,991	1904	193,498	1,021,778
1897	73,962	2,435,814	1905	134,588	770,689
1898	102,337	1,415,013	1906	100,083	766,138
1899	117,891	1,619,351	1907	127,812	830,659
1900	134,696	2,244,222	1908	161,246	962,508
1901	148,574	1,700,355	1909	134,200	671,230
1902	184,066	1,242,438			

Forest products made up the bulk of the commerce. Twenty-eight per cent of the commerce reported was rafted saw logs floated with the current.

July 1, 1908, balance unexpended	$18,031.87
Receipts from sales	17.60
Amount allotted from appropriation by river and harbor act approved March 3, 1909	16,000.00
	34,049.47
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	11,107.90
July 1, 1909, balance unexpended	22,941.57
July 1, 1909, outstanding liabilities	618.22
July 1, 1909, balance available	22,323.35

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	**$17,500.00**
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix W 2.)

3. Arkansas River at Pine Bluff and White River at Augusta Narrows, Arkansas.—Statement of original condition of river, range and floods, commercial statistics, etc., will be found in reports for improving Arkansas River, Arkansas, and for improving White River, Arkansas.

The Board of Engineers appointed pursuant to requirement of the river and harbor act of March 2, 1907, recommended the construction of a levee and revetment at Augusta Narrows, on White River, and the construction of a levee along Vaugine Neck, opposite Pine Bluff, on the Arkansas River, and that such amount of the $100,000 appropriated by that act as was not needed for those works be reserved for repairs or for further work that might be found necessary. The works recommended by the Board have been completed, and the balance of the appropriation not used on those works has been made available for use in repairing and restoring the revetment works along the town front of Pine Bluff, the major portion of those works having been destroyed by two freshets that occurred in October and November, 1908. For use in connection with that balance, $20,000 was allotted from the emergency funds provided by river and harbor acts of 1905 and 1907. The work done under this balance and the allotments was that of building 3,100 linear feet of subaqueous mattress, 120 feet wide, from State street to Kentucky street, and paving 1,800 linear feet from Tennessee street to Kentucky street. Citizens of Pine Bluff, through a local organization, and the county court of Jefferson County built 1,283 linear feet of subaqueous mattress from State street up to Dike No. 3. These organizations also did some temporary high-water protection work during the duration of the two freshets in an effort to arrest the caving and prevent the destruction of buildings along the caving bank.

The river and harbor act of March 3, 1909, made a direct appropriation for work at Pine Bluff, and further report of work done at that place during the fiscal year will be found under the heading "Arkansas River at Pine Bluff," (p. 539 of this report).

To June 30, 1909, the expenditures under this heading have been $114,405.74, of which $15,586.66 was for Augusta revetment, $10,186.05 for Augusta levee, $55,175.22 for levee along Vaugine Neck, and $33,457.81 for maintenance and restoration of works at Pine Bluff. Two thousand and forty-three dollars of the $20,000 allotted from emergency river and harbor acts were returned to the Treasury.

The balance on hand July 1, 1909, will be expended in payment of outstanding liabilities.

July 1, 1908, balance unexpended		$80,590.32
Amount allotted from emergency river and harbor acts of 1905 and 1907		20,000.00
		100,590.32
June 30, 1909, amount expended during fiscal year:		
For maintenance of improvement	$6,000.00	
For works of improvement	88,996.06	
Returned to Treasury to credit of emergency appropriation act, 1907	2,043.00	
		97,039.06
July 1, 1909, balance unexpended		3,551.26
July 1, 1909, outstanding liabilities		3,551.26

(See Appendix W 3.)

4. Arkansas River at Pine Bluff, Ark.—This work is that of completing the restoration of 9,200 linear feet of revetment work that was built along the town front of Pine Bluff in fiscal years 1892–1896 and which was destroyed during freshets in October and November, 1908. The rebuilding of this revetment was begun under the appropriation title "Arkansas River at Pine Bluff and White River at Augusta Narrows, Arkansas." The work done under this title—"Arkansas River at Pine Bluff"—this fiscal year was that of building 1,000 linear feet of channel mattress, 120 feet wide, and grading and paving 250 linear feet of bank, and taken in connection with that done under the combined appropriation just mentioned and that done by the citizens of Pine Bluff makes at the close of the fiscal year 5,383 linear feet of channel mattress built and 2,050 linear feet of bank completely paved.

The expenditures under this head to June 30, 1909 were $4,522.16.

The balance available July 1, 1909, will be expended in completing the restoration of the revetment along the town front of Pine Bluff.

For commercial statistics, physical characteristics of the river, and estimate for fiscal year 1911 see "Arkansas River, Arkansas."

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$97,200.00
June 30, 1909, amount expended during fiscal year for works of improvement	4,522.16
July 1, 1909, balance unexpended	92,677.84
July 1, 1909, outstanding liabilities	13,236.84
July 1, 1909, balance available	79,441.00
July 1, 1909, amount covered by uncompleted contracts	7,360.00

(See Appendix W 4.)

5. Upper White River, Arkansas.—Earlier works on this portion of White River were made under appropriations for improving White River, Arkansas, and have been fully reported upon under that head.

The original condition of the river and previous projects for its improvement are also reported there.

The existing project, adopted March 3, 1899, is based on a report printed in the Annual Report of the Chief of Engineers for 1897, page 1992, and is to provide slack-water navigation from Batesville, Ark., to Buffalo shoals, 89 miles, by 10 fixed dams with concrete locks. The locks are to be 175 feet between hollow quoins and 36 feet wide, with a depth of about 4 feet on the lower miter sills. The estimated cost is there given as $1,600,000 for the 10 locks and dams.

To the close of the fiscal year ending June 30, 1909, there have been expended on this work $813,195. Three locks and dams have been built and are operated under the indefinite appropriation for "Operating and Care of Canals and other Works of Navigation."

A board of engineers appointed pursuant to requirement of the river and harbor act of March 3, 1905, to consider this project reported the construction of further locks and dams not desirable. This report is printed in House Document No. 150, Fifty-ninth Congress, first session.

Forsyth, Mo., 204 miles above Batesville, is the head of steamboat navigation. The channel depths over the shoals in the unimproved part of the river are small, being only 8 to 10 inches during lowest waters. The range between high and low water at Buffalo City, the head of this project, is about 45 feet. Below Dam No. 1, at Batesville, this range is 35.5 feet.

For commercial statistics, see report on "Operating and care of locks and dams, Upper White River, Arkansas."

July 1, 1908, balance unexpended	$4,641.64
Receipts from sales	6.69
	4,648.33
June 30, 1909, amount expended during fiscal year, for works of improvement	[a] 4,134.80
July 1, 1909, balance unexpended	[b] 513.53
July 1, 1909, outstanding liabilities	513.53

(See Appendix W 5.)

6. Operating and care of Locks and Dams Nos. 1, 2, and 3, upper White River, Arkansas.—These locks and dams were built with funds derived from appropriations for improving upper White River, Arkansas. The available length of the locks is 147 feet, available width is 35 feet, and depth over the miter sills at normal pool levels is 5 feet. Lock and Dam No. 1 was placed under this appropriation on January 16, 1904; Lock and Dam No. 2, on February 16, 1905, and Lock and Dam No. 3, on February 1, 1908.

The high-water mark of May, 1898 (before the dams were built) is 22 feet above the crest of Dam No. 1, 18.4 feet above the crest of Dam No. 2, and 25.2 feet above the crest of Dam No. 3. The highest stages reached by the river since the dams have been completed were 20 feet above the crest of Dam No. 1 and 18.2 feet above the crest of Dam No. 2, on May 8, 1907. Since the completion of Dam No. 3 there has been no extreme high water. The lowest stages this fiscal year were 0.1 foot above the crest of Dam No. 1 and 0.3 foot above the crests of Dams Nos. 2 and 3, on November 20, 1908.

The expenditures during this fiscal year were for ordinary operating expenses of the locks and for some minor repairs to structures and plant.

The total amount expended under this head to June 30, 1909, is $132,109.17, of which $17,448.03 was expended this fiscal year.

---

[a] Lock and Dam No. 3.

[b] Lock No. 1, $214.50; Lock No. 2, $83.75; Lock No. 3, $215.28.

Commercial statistics, year ending May 31.

Year.	Lock No. 1.		Lock No. 2.		Lock No. 3.		Freights that did not pass through a lock.
	Lockages.	Freights.	Lockages.	Freights.	Lockages.	Freights.	
	Number.	*Tons.*	*Number.*	*Tons.*	*Number.*	*Tons.*	*Tons.*
1904	[a] 115	8,320	....	....	....	....	7,335
1905	244	8,771	[b] 60	4,163	....	....	5,000
1906	246	7,306	183	8,692	....	....	2,496
1907	191	6,798	263	9,431	....	....	1,283
1908	249	13,746	661	22,077	[c] 126	4,337	7,533
1909	190	4,427	549	14,143	310	7,162	5,143

[a] Four months. [b] Three and one-half months. [c] Five months.

(See Appendix W 6.)

7. *Cache River, Arkansas.*—In its original condition this river was much obstructed by snags, drift, and overhanging timber. The low-water depth on the controlling shoals was 6 to 8 inches.

The original project, adopted by the act of August 11, 1888, was to remove logs, snags, and overhanging timber from the mouth to Riverside (102 miles). The amount expended on this project was $9,000.

The river and harbor acts of August 18, 1894, and June 3, 1896, each authorized the Secretary of War to expend $2,000 of the White River appropriations on this stream. The funds obtained from those acts and from subsequent ones have been expended in maintenance of channel below James Ferry, 79 miles above the mouth of the river, by snagging operations.

To June 30, 1909, there had been expended on this work $19,984.36, of which $9,000 was for work under the original project and $10,984.36 was for maintenance of channel.

The operations have been of material benefit to commerce in lengthening the navigable periods by rendering the natural depths of the stream available for navigation purposes.

Gray's bridge, 95 miles above the mouth of the river, is considered the head of steamboat navigation, but the river is not navigable to that point all the year, the ruling depth in the channels over the shoals throughout the river being only 8 to 10 inches during lowest water. During high-water seasons rafts are run from 100 or more miles above Gray's bridge. In the vicinity of James Ferry (79 miles above the mouth of the river and the upper limit of snagging operations now) the range between high and low water is about 15 feet. Because of backwater from White River this range is increased to 24 feet at Rock Island Railway bridge and to 32 feet at the mouth of the river.

Reports of the more recent preliminary examinations of this river are given in the Annual Report of the Chief of Engineers for 1887, page 1547, and in the Annual Report of the Chief of Engineers for 1895, page 2037.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	12,603	$25,494	1903	16,843	$109,681
1896	20,748	62,483	1904	15,865	49,601
1897	34,990	108,460	1905	11,660	29,860
1898	10,193	36,635	1906	10,942	31,777
1899	7,667	52,936	1907	13,050	39,225
1900	11,215	29,961	1908	21,173	59,254
1901	10,374	30,100	1909	9,420	36,150
1902	15,676	40,301			

The tonnage reported this year was made up of rafted saw logs and barged railway ties.

The balance available July 1, 1909, and the additional appropriation recommended will be expended in snagging operations for maintenance of channel.

July 1, 1908, balance unexpended	$2,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	5,000.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,984.36
July 1, 1909, balance unexpended	3,015.64
July 1, 1909, outstanding liabilities	15.64
July 1, 1909, balance available	3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix W 7.)

8. *Black and Current rivers, Arkansas and Missouri.*—Prior to fiscal year 1905 the work on these rivers was provided for under separate appropriation titles. The works were consolidated by river and harbor act of March 3, 1905.

(*a*) *Black River.*—In its original condition this river below the mouth of Current River had, at ordinary low water, a controlling depth of 2 to 2½ feet on the shoals, but this was not available on account of snags and similar obstructions. Above the mouth of Current River navigation was practically impossible at ordinary low stages, and no rafting was possible above the Arkansas and Missouri state line.

The original project, adopted by act of June 14, 1880, contemplated removing logs, etc., cutting down shoals by means of wing dams, and closing some of the most troublesome sloughs. The estimated cost was $80,800. The only modification of the project has been that of changing the estimate to $8,000 a year for maintenance. The district officer recommends that this be increased to $18,000 for the two streams.

To June 30, 1909, there had been expended on this work $165,859.24.

Poplar Bluff, Mo., 239 miles above the mouth of the river, is the head of navigation. All-the-year navigation has been made possible to this place for boats of not over 18 inches draft. Boats of not over 2½ feet draft can navigate this river below the mouth of Current River, 116 miles, during the lowest waters, and this portion of the river is generally spoken of as being navigable for 3-foot boats at any time.

The range between high and low water at Poplar Bluff is 19 feet. This difference decreases below Poplar Bluff, and in the flat lands to the southward it averages about half of this, being 8.5 feet at Corning bridge, 70 miles below Poplar Bluff. After passing to below head of Little River the difference between high and low water increases, and at Pocahontas, 129 miles below Poplar Bluff, the difference is 26.5 feet, and at the mouth of the river it is 34.4 feet.

The operations during this fiscal year consisted in snagging operations carried on by the hand-propelled snag boat *Riverside* working between Poplar Bluff and the mouth of Current River and the snag boat *Quapaw* working below the mouth of Current River. By these operations 1,344 snags were removed from the channel, 1,816 trees cut, and 15 drifts broken up.

The report of the examination upon which the present project for the improvement of Black River is based is given in the Annual Report of the Chief of Engineers for 1880, page 1326.

(*b*) *Current River.*—The original condition of this stream was such that no steamboat navigation above the mouth of Little Black River was attempted except when the river was at high stages. Below Little Black River navigation was suspended when the river was below medium stage. The natural depths were not available on account of snags and leaning trees.

Although the United States made some improvements to this stream in 1873, and again in 1882 and 1883, the regular improvement of it was not undertaken until act of Congress of August 18, 1894, adopted a project for its improvement from Van Buren, Mo., to the mouth by snagging operations and by contracting the channel at the worst shoals by wing dams, at an estimated cost of $10,000. The appropriation of June 3, 1896, completed the amount originally estimated for the completion of the project, and all operations since then have been under estimates for maintenance. No wing dams have been built, all operations having been confined to snagging.

To June 30, 1909, there has been expended on this river $41,463.71, $7,000 of which was in the early work mentioned above, leaving $34,463.71 as the amount expended on the existing project. Of this latter amount, $24,463.71 was for maintenance.

Reference to the preliminary examination of this stream and to a subsequent examination of it is given on page 408 of Annual Report for 1904.

Van Buren, Mo., 94.5 miles above the mouth of the river, was taken as the head of navigation when the earlier projects for this river were adopted. Small gasoline boats occasionally ply the river that far up, and rafts are run over the entire river, but Pitmans Landing, near the state line between Arkansas and Missouri and 41 miles above the mouth of the river, is generally spoken of as the head of steamboat navigation. Boats can not reach that point, however, during low-water seasons, the low-water depths of the river being as follows: Three feet from the mouth to Blunts (Johnsons Landing), 25 miles; 2 feet from Blunts to mouth of Little Black River, 7 miles; and 16 inches from mouth of Little Black River to Pitmans Landing, 9 miles. From Pitmans Landing to Doniphan, 12 miles, the head of the work done by snag boats now, the low-water depths are about 12 inches.

The range between high and low water at Van Buren is about 16 feet, and this range does not vary much until below the mouth of Little Black River, when the range increases to 19 feet.

During this fiscal year the snag boat *Riverside* (hand propelled) worked over the river below state line, 42 miles. Six hundred and sixty-six snags were removed from the channel and 1,463 overhanging trees were cut.

Commercial statistics.

Year ending May 31—	Black River.		Current River.	
	Value.	Tons.	Value.	Tons.
1895	$1,065,415	132,433	$362,447	31,205
1896	891,437	111,278	227,291	29,867
1897	1,704,799	111,611	581,528	17,078
1898	788,640	115,612	306,216	52,417
1899	529,336	83,404	239,869	43,050
1900	966,961	129,698	578,834	65,043
1901	989,635	185,714	234,555	64,102
1902	919,767	166,213	165,766	37,185
1903	695,649	138,181	142,899	45,309
1904	1,092,648	191,285	139,119	55,573
1905	1,004,299	144,065	409,297	74,048
1906	625,985	139,384	152,216	47,704
1907	692,968	107,914	226,655	48,486
1908	517,905	140,826	115,398	27,696
1909	439,355	86,070	36,802	10,735

Logging and kindred industries furnished the bulk of the commerce. Of the commerce reported this year 54 per cent of that on Black River and 6 per cent of that on Current River was rafted saw logs and railway ties.

The balance available July 1, 1909, will be expended in snagging operations. The amount estimated as being needed during the fiscal year ending June 30, 1911, is for maintenance of channel by snagging operations.

BLACK RIVER.

July 1, 1908, balance unexpended	$6,020.42
Receipts from sales	3.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	12,000.00
	18,023.42
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,142.16
July 1, 1909, balance unexpended	12,881.26
July 1, 1909, outstanding liabilities	486.11
July 1, 1909, balance available	12,395.15
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a]

---

[a] See consolidated money statement on page 545.

CURRENT RIVER.

July 1, 1908, balance unexpended	$1,966.16
Amount allotted from appropriation by river and harbor act approved March 3, 1909	6,000.00
	7,966.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,594.87
July 1, 1909, balance unexpended	6,371.29
July 1, 1909, outstanding liabilities	4.00
July 1, 1909, balance available	6,367.29
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

CONSOLIDATED.

July 1, 1908, balance unexpended	$7,986.58
Receipts from sales	3.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	18,000.00
	25,989.58
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,737.03
July 1, 1909, balance unexpended	19,252.55
July 1, 1909, outstanding liabilities	490.11
July 1, 1909, balance available	18,762.44
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	19,500.00

(See Appendix W 8.)

9. St. Francis and L'Anguille rivers, Arkansas.—(*a*) *St. Francis River.*—In its original condition this stream was not navigable above Lesters Landing at any stage; between Lesters Landing and Marked Tree navigation was possible at high stages only, and below Marked Tree it was difficult at medium and lower stages and impossible at extreme low water.

The original project, adopted by act of March 3, 1871, contemplated improvement from the mouth to Wittsburg by snagging operations. For the period 1873–1882 the appropriations were made for this work in connection with White River, Arkansas. By act of June 14, 1880, appropriation was made for improving the river from Wittsburg to Lesters Landing, the project for the expenditure of this appropriation being to cut a channel through "The Lake" and clear the river of obstructions by snagging operations. Appropriation made by act of July 5, 1884, was the first separate appropriation for the entire river. The act did not state the limits within which it was to be applied. Under it snagging operations were carried on to the town of St. Francis, Ark., and several of the sloughs or side channels were closed. When the improvement of St. Francis River, Missouri, was begun (act of August 11, 1888), Kennett, Mo., was taken for the upper limit of this work, making the existing project—

---

[a] See consolidated money statement on this page.

> removal of logs, drifts, and snags from the channel, and overhanging timber from the banks from the mouth to Kennett, Mo., and closing the chutes and sloughs in the Sunk Lands, so as to make the river navigable at high stages to Kennett, Mo., at medium stages to Marked Tree, and at low stages to a point 30 miles below Madison, Ark., the estimated cost being $8,000 annually.

(*b*) *L'Anguille River.*—By acts of June 18, 1878, March 3, 1879, and June 14, 1880, a total of $17,000 was appropriated for snagging operations on L'Anguille River to Marianna. This was finally expended in fiscal year ending June 30, 1887. Act of June 13, 1902, revived this work and included it with St. Francis River.

There has been expended on these rivers to June 30, 1909, $121,562.03. This amount, however, does not include the expenditures on St. Francis River while it was combined with White River, as those expenditures can not be determined.

By the early operations the St. Francis River between Wittsburg and Lesters Landing was improved to such an extent that boats could reach the latter-named place on the same stage as they could the former. By subsequent operations the period of navigation below Wittsburg was lengthened about two months, and above Lesters Landing a fair high-water channel was made. The improvements thus made below Wittsburg have been maintained. No effort is being made to maintain those above Marked Tree, the commerce on that portion of the river not warranting any expenditures at this time. During periods of low water neither stream is navigable, there not being sufficient depth of water over the shoals. Marianna is the head of navigation on L'Anguille River. The head of navigation on St. Francis River is near Wappapello, Mo., about 100 miles above Kennett, Mo., the upper limit of the portion of the river covered by this project. Lying between Kennett, Mo., and Foot of Lake, 80 miles below, are the Sunken Lands of the St. Francis, one vast swamp, through which the river flows in several channels, none of which is well defined and all of which are more or less obstructed and frequently blocked. Lesters Landing is 34 miles above Foot of Lake and is the practicable head of navigation on the St. Francis River in Arkansas. Boats can pass between it and Kennett, Mo., only during high stages, and then only with great difficulty.

The range between high and low water of St. Francis River at Lesters Landing is about 3 feet. This increases to 16 feet at Marked Tree, and this range is probably the maximum that would exist at any point below there were it not for the backwater from the Mississippi River. At Madison the extreme range is about 33 feet, and at the mouth of the river it is about 55 feet.

Reference to examination and survey of these rivers with a view to improvement by means of locks and dams is given on page 410 of Annual Report for 1904. Reference to report of examination of St. Francis River from its mouth to St. Francis, Ark., will be found on page 460 of Annual Report for 1906.

During this fiscal year the hand-propelled snag boat *A. B. Johnson* worked over St. Francis River between its mouth and Marked Tree, 171 miles. Nine hundred and ninety-nine snags were removed from the channel, 5,055 trees cut, and 10 drifts broken up.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1894	19,763	$98,375	1902	85,831	$269,190
1895	38,107	321,439	1903	88,035	294,495
1896	67,740	401,457	1904	119,172	423,469
1897	97,348	1,117,891	1905	142,098	590,560
1898	23,819	237,481	1906	137,319	472,257
1899	27,892	315,459	1907	151,015	833,397
1900	45,065	194,237	1908	286,820	1,376,757
1901	57,102	272,609	1909	160,057	1,148,855

Fifty-four per cent of the commerce reported was rafted saw logs floated with the current.

The balance available July 1, 1909, will be expended in snagging operations. The amount estimated as being needed during the fiscal year ending June 30, 1911, is for maintenance of channel by snagging operations.

July 1, 1908, balance unexpended	$6,777.97
Receipts from sales	3.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	9,000.00
	15,780.97
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,102.47
July 1, 1909, balance unexpended	10,678.50
July 1, 1909, outstanding liabilities	517.12
July 1, 1909, balance available	10,161.38
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	9,000.00

(See Appendix W 9.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated September 13, 1907, and September 30, 1908, respectively, on preliminary examination, with plan and estimate of cost of improvement, of *Saline River, Arkansas*, from the mouth of the same north to Turtle bar, on said river, with a view to dredging and other work, required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1212, Sixtieth Congress, second session. An estimate of cost of improvement, amounting to $5,400, is presented.

EXAMINATION OF ARKANSAS RIVER UP TO MUSKOGEE AND AT PINE BLUFF; RED RIVER BETWEEN FULTON, ARK., AND MOUTH OF WASHITA RIVER; AND WHITE RIVER AT AUGUSTA NARROWS, ARKANSAS, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated May 27, 1907, December 30, 1907, and March 27, 1909, by a Board of Engineers, of examinations of *Arkansas River up to Muskogee and at Pine Bluff; Red River between Fulton, Ark., and mouth of Washita River; and White River at Augusta Narrows, Arkansas*, required by the river and harbor act of March 2, 1907, were duly submitted and were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. The reports were transmitted to Congress and printed in House Document No. 71, Sixty-first Congress, first session. Plans for improvement are presented as follows:

(*a*) Arkansas River from the mouth to Little Rock at an estimated first cost for plant of $300,000, and $100,000 annually for maintenance;

(*b*) Red River between Fulton, Ark., and the mouth of the Washita River, estimated to cost $160,000 for the first two years and $50,000 annually thereafter for maintenance; and

(*c*) Arkansas River at Pine Bluff and White River at Augusta Narrows. The work proposed by the Board being considered as required in the interests of navigation, the sum of $100,000 conditionally appropriated by the act of March 2, 1907, became available for the work and was applied to the improvement of these localities.

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1909.

Reports on preliminary examinations required by the river and harbor act of March 3, 1909, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination of Arkansas River at Douglas, Ark., with a view to determining what improvements are necessary in the interest of navigation.*—Report dated April 2, 1909, is printed in House Document No. 69, Sixty-first Congress, first session. No improvement at Douglas is considered necessary in the interest of navigation beyond that contemplated by existing project.

2. *Preliminary examination, with plan and estimate of cost of improvement, of Blackfish Bayou, Arkansas, from its mouth to Fifteenmile Bayou.*—Reports dated April 3, 1909, and May 17, 1909, respectively, are printed in House Document No. 73, Sixty-first Congress, first session. An estimate of cost amounting to $9,500 is presented.

3. *Preliminary examination of Little Black River, Arkansas and Missouri.*—Report dated April 20, 1909, is printed in House Document No. 74, Sixty-first Congress, first session. This stream is not considered worthy of improvement by the General Government.

IMPROVEMENT OF RIVERS AND HARBORS IN THE ST. LOUIS, MISSOURI, DISTRICT.

This district was in the temporary charge of Capt. G. R. Lukesh, Corps of Engineers, to September 30, 1908, and in the charge of Col. W. H. Bixby, Corps of Engineers, division engineer, western division, since that date.

1. *Removing snags and wrecks from the Mississippi River below the mouth of the Missouri River.*—When this work was originally begun the navigation of the river was seriously obstructed by numerous snags, logs, etc., which had lodged in the channel, and to which additions were made with each rise of the river. A large number of wrecked flatboats, barges, steamboats, and other river craft also obstructed the navigable channels, and menaced life and property.

For the removal of these obstructions appropriations were made as early as 1824. The project adopted consisted of building boats suitable for removing snags, logs, drift heaps, wrecks, etc., and operating them whenever the stage of river was favorable and funds were available, and in cutting trees from caving banks to prevent their falling into the river and becoming obstructions to navigation.

The existing project is a continuation of the plan adopted in 1879, when the first specific appropriation for removing snags, wrecks, etc. from the Mississippi River was made by the river and harbor act approved March 3 of that year. Specific appropriations or allotments were made for this work each year thereafter, except 1883, 1885, and 1887, but by section 7 of the river and harbor act of August 11, 1888, a continuous annual expenditure of $100,000, or as much thereof as might be necessary, was authorized for the maintenance of this service, and this amount has been available each year since to the present time. The river and harbor act of March 3, 1909, makes so much of this appropriation, as the Secretary of War may deem necessary, available for the removal of snags and other floating and sunken obstructions in the Atchafalaya and Old rivers from their junction with the Mississippi and Red rivers down the Atchafalaya River as far as Melville, La.

No modification of the project has been made since its adoption, the plan being continuous, and new obstructions being brought down by each flood in the river. So much of the continuous appropriation as may be required each year will be applied to their removal.

The amount expended upon this work prior to June 30, 1872, can not now be ascertained, for the reason that during that time and to March 3, 1879, appropriations were made in lump sums, principally under the title "Improvement of Mississippi, Missouri, and Arkansas rivers," to be applied to the several streams as their needs or the terms of the law required. The available records do not show the amount applied to each stream.

The approximate amount expended from July 1, 1872, to June 30, 1880, was $493,437.23, and the definitely known amount expended from July 1, 1880, to June 30, 1909, was $2,203,977.85, making the total of approximate and known expenditures to date $2,697,415.08.

From March 28, 1868 (the earliest date of available record of work done), to June 30, 1909, 96,364 snags were pulled, 81 wrecks and 636 drift piles were removed, and 444,070 trees were cut, greatly improving the river and lessening the dangers of navigation.

During the fiscal year in review two steel-hull snag boats were engaged in removing such obstructions between the mouth of the Missouri River and New Orleans, La., a distance of about 1,270 miles, and 4,526 snags were destroyed, 27 drift piles and 23 wrecks were removed, 2,406 trees were cut, and 13,068 miles patrolled.

In addition to this work part of the funds appropriated for the removal of obstructions was expended in the partial removal of Beaver Dam rock, an obstructive and dangerous rock lying in mid-channel about 1 mile below Commerce, Mo. A beginning was made upon this work (which can only be done economically at low and favorable river stages) during the preceding fiscal year (1908), when about one-sixth of the drilling and blasting were completed. During the past fiscal year as much more was done, so that about one-third of the whole is now accomplished. Work will be continued at each low-water season as opportunity offers and funds are available, until the entire rock is removed to the plane desired.

For information as to the commerce benefited by work under this appropriation, reference should be made to the commercial statistics in the report upon improving the Mississippi River between the Ohio and Missouri rivers and in the reports of the Mississippi River Commission and the district officers thereunder. The amount expended during the year was $100,021.03.

(See Appendix X 1.)

2. *Mississippi River between Ohio and Missouri rivers.*—In its original condition, prior to any improvement, the navigable channel of this section of the Mississippi River had a natural depth in many places of only 3½ to 4 feet at low water. The main channels were divided by islands and bars, which formed chutes, sloughs, and secondary channels, through which a considerable part of the volume of the flow was diverted to the detriment of navigation.

The first systematic effort to improve this condition was begun by the Federal Government in 1872, and was continued for a number of years as appropriations were made, the works of improvement consisting of dikes and dams of brush and stone, to confine the low-water volume in the vicinity to a single channel, and of revetments to hold and preserve the banks where it was thought necessary or advisable.

The project followed in later years and up to the present time has been practically that adopted in 1881, approved by letter of the Chief of Engineers dated March 31, 1881, contemplating the confinement of the flow of the river below St. Louis to a single channel having an approximate width of 2,500 feet at bank-full stage, the natural width in many cases being a mile or more at mean high water, this result to be secured by closing sloughs and secondary channels and by building out new banks where the natural width is excessive, using for the purpose permeable dikes or hurdles of piling to collect and hold the solid matter carried in suspension or rolled on the bottom by the river, the banks, both new and old, to be revetted or otherwise protected where necessary to secure permanency. Modifications of the project in the river and harbor acts of 1896 and 1902 provided that, pending the completion of the permanent improvement, the low-water channel should be improved each season by the use of dredges and other temporary expedients.

Under the provisions of the river and harbor act of June 13, 1902, and special resolutions of the Committee on Rivers and Harbors of April 25, 1903, the special engineer board considered and submitted a report upon the conditions, best methods of work, and cost of a suitable channel in this part of the Mississippi River. This report, under date of November 12, 1903, recommended a channel which would have at low water at least 200 feet width with 8 feet depth from Cairo to St. Louis, and with 6 feet depth from St. Louis to the mouth of the Missouri, to be secured by side contraction works and shore protection, assisted by dredging, the permanent construction work to cost about $20,000,000, in addition to all expenditures already made, and its maintenance to cost about $400,000 per year; and, with a view to the prompt execution of such project, this report further recommended an immediate appropriation of $450,000 for additional dredging plant and $250,000 per year for three years' operation of the same, together with $300,000 per year for permanent construction works and temporary expedients until the results of such dredging should be known and should allow a revision of the project. The river and harbor acts of March 3, 1905, and of March 2, 1907, appropriated or authorized contracts and work to the amount of $1,450,000 for the new plant and for its operation for five years (1906, 1908 to 1911), and the latter act provides that the sums now available shall be expended in the operation and maintenance of dredging plants already constructed and in temporary expedients of channel regulation connected with such operation, and in maintenance and repair of the permanent works already constructed, and that such portion of the $250,000 per year as is not necessary for the above work may be expended in construction of permanent works of channel regulation. The dredging has required annually so much of this appropriation that only about $30,000 to $50,000 per year has been available for the less urgent work. The action of Congress up to the present time has therefore followed the recommendations of the Board's report of November 12, 1903, except that it has allowed only a small portion (about $150,000 total during four years) of the appropriations to be used upon the repair and maintenance and new construction of permanent works instead of $300,000 per year recommended therefor by the 1903 Board for the years of experimental dredging. The results of the dredging work above authorized and done now show that the 1881 project, as revised by the 1903 Board, needs no further revision other than to add urgent recommendations for annual appropriations large enough to allow of the completion of the $20,000,000 project within a reasonable term of years. This view is also confirmed by the recent report of the special Board on Examination and Survey of the Mississippi River from the Lakes to the Gulf, dated March 20, 1909, which virtually recommends the early completion of the 1881 project as indorsed and modified by the 1903 Board, and which puts its cost at about $21,000,000 ($1,000,000 being added to compensate for the deterioration of permanent works during recent years while their repair has been prevented by lack of recommended appropriations).

Continuing contracts for $250,000 for the year commencing July 1, 1910, are already authorized by the act of March 2, 1907, to be provided for in the next sundry civil act; but in addition thereto the $300,000 per year for repair, maintenance, and new construction of permanent works recommended by the 1903 Board, after increase to $400,000 to partially compensate for deficiencies since 1903, should also be authorized for the coming year to provide for checking further serious destruction and depreciation of existing works.

The object of the previous and present plans of improvement is to obtain and maintain a minimum depth at standard low water of 6 feet from the mouth of the Missouri to St. Louis and of 8 feet from St. Louis to the mouth of the Ohio.

The amount expended to June 30, 1909, was $12,718,126.03, exclusive of $180,000 allotted by acts to projects for improvement between the Illinois and Missouri rivers, including Alton Harbor.

The result of the expenditure of this amount has been the partial permanent improvement of the entire extent of the river from St. Louis to Cairo, and during recent years practically the maintenance of the depths required.

The new appropriation asked for is the estimated expenditure for one year only, and should be increased by authorization under continuing contracts for other years by at least the same sum annually until a new plan is authorized by Congress.

It is proposed to expend the new appropriation asked for in dredging and in such temporary and permanent improvements as may be necessary and authorized by law.

The amount expended during the fiscal year ending June 30, 1909, was $341,824.44, and includes $213,932.76 expended for dredges and dredging, the remainder going to the care of plant and to the maintenance and repair of existing works of revetment, which had been much damaged by the action of the river and were urgently in need of such work. The total amount thus far expended for temporary channel improvement is $1,422,541.32, much of which has been for dredging plant that is now on hand and available for future work. The approximate value of this dredging plant is $509,890.42, having been considerably augmented by the completion and addition of the two new dredges referred to.

This improvement has probably had a beneficial influence on freight rates, as the rates to localities reached by water are well known to be lower than those remote from this advantage, but an accurate estimation of such effect is impracticable.

During the past year there was maintained a channel depth of 8 feet during the entire season when the river was unobstructed by ice, except for short periods at several places the depths were 7 feet until dredges could be brought into action upon these shoals, when the required depth was quickly obtained; and at two places, Chain of Rocks and Grand Tower, where 7 feet was the maximum obtained, due, at the former to the location of the channel across the solid rock, and at the latter to the natural silting up and closing of the chute east of Grand Tower Island, forcing the boat channel to the west of that island over a bar of gravel and small bowlders which could not be moved by the suction type of dredges in use.

The river at St. Louis reached a high-water stage of 26.9 feet above standard low water (4 feet St. Louis gauge) on July 1, 1908, and a low-water stage of 5.4 feet below standard low water on January 12, 1909.

With the present appliances and such others as are authorized for the temporary improvement of low-water channels and for works of permanent improvement, it is expected that a navigable depth of about 8 feet can be maintained between St. Louis and Cairo during all stages of river open to navigation.

Recapitulation of commercial statistics.

	1905.	1906.	1907.	1908.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Receipts and shipments at St. Louis	370,425	416,855	368,075	365,920
Transferred by ferries at St. Louis	6,684,949	7,374,978	8,905,542	5,600,765
Shipped from landings between St. Louis and Cairo	69,729	62,238	65,467	8,173
Total	7,125,103	7,854,071	9,339,084	5,974,858

July 1, 1908, balance unexpended	$376,703.86
Amount appropriated by sundry civil act approved March 4, 1909	250,000.00
June 30, 1909, miscellaneous receipts	23,232.22
	649,936.08
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	[a] 341,843.07
July 1, 1909, balance unexpended	[b] 308,093.01
July 1, 1909, outstanding liabilities	16,519.03
July 1, 1909, balance available	[b] 291,573.98
Amount (estimated) required for completion of existing project	[c] 17,501,654.55
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[d] 250,000.00

(See Appendix X 2.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE ROCK ISLAND, ILLINOIS, DISTRICT.

This district was in the charge of Maj. C. S. Riché, Corps of Engineers. Division engineer, Col. W. H. Bixby, Corps of Engineers.

1. Operating snag boats and dredge boats on upper Mississippi River and tributaries.—By the river and harbor act of August 11, 1888, provision was made for securing the uninterrupted work of snag boats and dredge boats on the upper Mississippi River under a permanent appropriation, the sum so expended not to exceed $25,000 annually.

---

[a] Deduct $18.63 expended in June, 1909, on account of inspections for the Isthmian Canal Commission, which had not been refunded at the end of the fiscal year, leaving net amount of $341,824.44 expended upon the improvement.

[b] From this amount deduct $10,000, allotment carried to the surplus fund June 30, 1909.

[c] Project of 1881 as modified in 1905.

[d] This estimate refers only to the work which Congress has specifically provided for under the continuing-contract authorization of March 2, 1907, and is the full amount allowed by said authorization. For the reasons given in the text of this report the appropriation of the additional sum of $400,000 is recommended

By river and harbor act of March 2, 1907, the annual appropriation for operating snag boats on the upper Mississippi River was made available for similar purposes on the Illinois River from its mouth to Copperas Creek.

By river and harbor act of March 3, 1909, the annual appropriation for operating snag boats was also made available for similar purposes on the Minnesota River and other tributaries of the upper Mississippi River, now or heretofore improved by the United States. This act extends the snag-boat jurisdiction on the Illinois River from Copperas Creek to La Salle, and on the Minnesota, the St. Croix, Chippewa, Wisconsin, Black, Galena, and Rock rivers.

During the past fiscal year the snag boat *David Tipton* (formerly *Colonel A. Mackenzie*) was employed from July 1 to November 12, 1908, and from April 3 to June 30, 1909, in removing snags and other obstructions, and otherwise assisting the interests of navigation in the Mississippi River between Minneapolis and the mouth of Missouri River, in the Illinois River from its mouth to La Salle, and in the Minnesota River.

The U. S. dipper dredge *Vulcan* was employed from July 9 to the middle of August in removing obstructions in front of St. Paul, and at several other localities between St. Paul and Fountain City.

The total amount expended for snag-boat service to June 30, 1909, was $1,049,584.

The total quantity of freight transported on the upper Mississippi River during the calendar year 1908 was about 2,581,857 tons and the ton-miles 227,761,355; in 1907, 3,919,440 tons, and 532,899,223 ton-miles.

The amount expended during the fiscal year ending June 30, 1909, was $25,000.

(See Appendix Y 1.)

2. Mississippi River between Missouri River and Minneapolis, Minn.—Between Missouri River and St. Paul, Minn.—Under this head is carried on the improvement of through navigation and also such special harbor or levee work as is provided for by Congress. Systematic work was begun in 1878, and such good results have been secured as to demonstrate that with a continuance of operations under liberal appropriations the low-water channel of the Mississippi River between St. Paul and the Missouri River can be made sufficiently deep, available, and permanent to satisfy the demands of commerce.

The original condition of the channel between the Missouri River and St. Paul was such that in low stages the larger boats were unable to proceed farther upstream than La Crosse or Winona, and in many seasons at points much lower down their progress was checked or seriously hindered.

The original project for the improvement, adopted in 1879, proposed the contraction of the channel or waterway by means of wing and closing dams to such an extent as, by means of the scour caused, to afford a channel of sufficient width and of a depth of 4½ feet at low water. There was expended under the original project and the provisional modified project of 1897 to June 30, 1909, $12,104,097.72, of which about $750,000 was applied to maintenance. At that date, and for many years previous, the condition of the channel was such as to permit the passage of the largest river boats at very low stages to St. Paul. It should be noted that of the amount above stated, $1,058,000 has been expended for harbors and levees not connected with through channel improvement, and that there is still available for these purposes $5,105.01.

The existing project, for the purpose of ultimately securing and maintaining a depth of 6 feet, was adopted by Congress March 2, 1907, and is given in full with detailed estimate in House Document No. 341, Fifty-ninth Congress, second session. It provides for further contraction of the channel, for auxiliary dredging, for a lateral canal at Rock Island Rapids and deepening Des Moines Rapids Canal, for repairs to existing work and for maintenance during construction. The estimate of cost, which does not include work between St. Paul and Minneapolis, is $20,000,000, provided it be completed within twenty years, and for care and maintenance after completion, $300,000 per annum. The said act appropriated $500,000, and authorized contracts for prosecuting this work to the amount of $1,500,000 additional, of which $500,000 is yet to be appropriated, and limited the cost of work for each year to $500,000 for three years. To June 30, 1909, the amount expended on this project was $911,420.62.

During the past year work has been carried on by hired labor and use of government plant in vicinity of Alma and Pine Island, between Minneopa and La Moille, at Richmond Island, in vicinity of North Buena Vista, Guttenberg, and Eagle Point, at Rock Island Rapids, in vicinity of Gilberts Island, at Atlas Island and Hickory Chute, and under formal contract in Cassville Chute and Guttenberg channel, above New Boston, at Benton Island, and in vicinity of Buzzard, Hadley, Fabius, and Armstrong islands. At all localities where work was performed good results were obtained.

With the expenditure during the past year an increased depth was obtained at several localities. Needed repairs were made to dams and shore protections that were broken, settled, or otherwise damaged.

The maximum draft that could be carried June 30, 1909, from the Missouri River to St. Paul, 658 miles, at mean low water (stage 1.5 above extreme low water) was, as nearly as could be ascertained, 4.5 feet. During the past year, on account of prevailing high stages of the river, there has been at no point less than 7 feet (except for about four weeks in September) except at the Des Moines Rapids Canal.

The navigation interests are important, although mush less than in former years, owing to the gradual decrease of the handling of logs and manufacture of lumber. The amount of freight carried during the season of 1908 was about 2,581,857 tons, having an approximate valuation of $33,295,531, the tonnage being about 34 per cent and the valuation 9 per cent less than in 1907. The number of ton-miles was 227,761,355.

The amount estimated as a profitable expenditure is to be used in the continuation of improvement work in accordance with the 6-foot project adopted by Congress, March 2, 1907, for the purpose of extension of benefits of navigation. It is the estimated expenditure for one year only.

An instance of the effect of river improvement and water competition on freight applying to that portion of the Mississippi River in question, taken from a report of the Upper Mississippi River Improvement Association, is here given:

A comparison of freight rates between points having water competition and an inland point.

From—	To—	Miles.	Route.	Classes.				
				1.	2.	3.	4.	5.
St. Louis	St. Paul	573	Rail	$0.63	$0.52½	$0.42	$0.26	$0.21
Do	do	729	Boat	.40	.34	.27	.17	.14
Do	Oklahoma	543	Rail	1.30	1.09	.97	.84	.67

While it is not claimed that river improvements are solely responsible for the great difference in freight rates above shown, it is well known that wherever water competition exists, whether by river, canal, or lake, its effect on freight rates is always beneficial to the public, and that so long as the navigation of the Mississippi River is feasible, and largely in proportion to its feasibility, such benefits will accrue, even if but little river commerce is actually carried on.

It is noted that the rate charged by the railroads on both banks of the river on freight from St. Louis to St. Paul is about 50 per cent greater than that charged by steamboats, and that the railroad rate to an inland point having no water competition, but at about the same distance, is more than 200 per cent greater. The same ratio prevails for less distances.

General Freight Agent Lusk, of the principal line of steamers on the upper Mississippi, the Diamond Jo, says:

> With the improvement of the river there would be a large increase in the freight traffic, for frequently during the past season by refusing heavy freight shipments we could run our steamboats to St. Paul and take care of the passenger traffic, but on account of the low water our earnings from freight were materially decreased.

From information furnished by lumbermen and raft-boat owners it is learned that the rate per ton-mile on logs and lumber floated down the river to various points ran from one-half mill to 1½ mills, the average rate being about 1 mill ($0.001).

The lowest rate by rail for lumber in carload lots between upper Mississippi River points, ascertained from actual shipments by this office from St. Paul to Fountain City, Rock Island, and Keokuk is 6 mills per ton-mile. This indicates a saving in freight by river of 5 mills per ton-mile, or $982,215 on the logs and lumber moved during 1908.

A classification of the freight carried by steamboats in 1908 was found impracticable, but on the least favorable showing in above table the saving was $0.07 per 100 pounds for 600 miles, or $0.00233 per ton-mile, which amounts in round numbers to $66,770. It is to be remembered that benefit also accrues to the public in the reduction, due to the river, of rates on freight carried by rail, the amount of which freight, although not definitely known, is thought to be much greater than that carried by boats. Were the improvement of the river to be abandoned and no further navigation practicable, the loss to the public during each year, on the basis of the rates to inland points, would be several millions.

The continued prosecution of the improvement to a greater extent than in recent years seems advisable, in order that the condition of the river for through navigation may be maintained and more rapidly improved. It is not anticipated that any further material reduction in freight rates on the adjacent railways will thus be had, but there would otherwise be danger that any lessened efficiency of the river for navigation would soon result in an increase in freight rates, and the volume of freight that might thus be affected is so great that a very small increase on these rail rates would annually exceed in total amount the recent annual appropriations for the portion of the Mississippi River in question.

For constructing, repairing, and revetting the Flint Creek to Iowa River levee and for protecting adjacent river bank there has been expended to June 30, 1909, $310,000. During the past year an additional allotment of $10,000 having been made in the sundry civil act of May 27, 1908, the shore protection at Crutchfield Prairie was repaired and extended 1,692 feet and 1,500 linear feet of shore protection was constructed in section 6 on the Iowa River. This levee runs from a point about 7 miles up the Iowa River down the west bank of that river and of the Mississippi River to Flint Creek near Burlington, Iowa.

For dredging Quincy Bay there has been expended to June 30, 1909, $129,481.36, and for Quincy Bay and bar at Quincy $26,178.21 additional. No work was done under this allotment during the year, and the unexpended balance is $640.81.

For the construction of a harbor of refuge below Davenport, Iowa, there has been expended to June 30, 1909, $13,068.05, for raising and repairing the dam at the head of Rockingham Slough and for dredging, sinking cribs, and driving piles. No work was done during the year.

For the channel and harbor at Hannibal, Mo., there has been expended to June 30, 1909, $59,762.67. No work was done during the past year.

For the harbor at Muscatine, Iowa, there has been expended to June 30, 1909, $43,148.60. No work was done during the past year.

For the harbor of refuge at Pepin, Wis., on Lake Pepin, there has been expended to June 30, 1909, $25,500. During the year the pier, the construction of which had been delayed for several years by high water, was completed.

For dredging at harbors and landing places, under allotments amounting to $100,000, there has been expended to June 30, 1909, $78,000. Satisfactory work was done during the past year at Redwing, La Crosse, Eagle Point, Cassville, Prairie du Chien, Moline, Quincy, and Hamburg.

July 1, 1908, balance unexpended	$640, 693. 37
Amount allotted from appropriation by river and harbor act approved March 3, 1909	500, 000. 00
Miscellaneous receipts	511. 75
	1, 141, 205. 12
June 30, 1909, amount expended during fiscal year, for works of improvement	645, 920. 52
July 1, 1909, balance unexpended	495, 284. 60
July 1, 1909, outstanding liabilities	40, 017. 80
July 1, 1909, balance available	455, 266. 80

July 1, 1909, amount covered by uncompleted contracts	$80,935.92
Amount (estimated) required for completion of existing project	18,500,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 500,000.00

(See Appendix Y 2.)

3. *Operating and care of Des Moines Rapids Canal and dry dock.*—During the past fiscal year the Des Moines Rapids Canal was open for navigation two hundred and forty-nine days, during which time there passed through it 1,180 steamboats and 261 barges, carrying 34,242 passengers, 7,878 tons of merchandise, and 2,500 bushels of grain. There also passed through the canal 600,000 feet b. m. of lumber, 10,903,000 feet of logs, 100,000 shingles, and 100,000 laths. This statement is about the same as that of the previous year, but is of little value, as, on account of high stages of water, most of the traffic passed over the rapids instead of through the canal.

The draft afforded by the canal is 5 feet at extreme low water, which may be increased to 6 feet at high stages. There are three locks having an available length of 325 feet and width of 78.5. The minimum width of the canal prism at water surface is 200 feet.

The dry dock was in constant use during the entire year.

The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

The total expenditures to June 30, 1909, amounted to $1,347,203.88 of which $43,185.70 was expended during the past year.

(See Appendix Y 3.)

4. *Mississippi River at Moline, Ill.*—The river and harbor act of March 3, 1905, adopted a definite project for improving Mississippi River at Moline by excavating a channel 250 feet wide and 4 feet deep at low water from the city of Moline to the head of the so-called arsenal dike above the city, and a similar channel connecting with the main river by means of a lock and dam at the foot of Benhams Island opposite the city, at an estimated cost of $386,000 and $10,000 annually for operation, care, and maintenance.

The entire amount of the estimate has been appropriated.

The amount expended to June 30, 1909, is $372,825.42.

The lock was practically completed and opened to navigation December 23, 1907.

Some work was done in removing rock from the upper approach and in dredging mud and sand near head of Arsenal Island.

For reference to the approved project, see Annual Report of the Chief of Engineers for 1905, page 429.

---

[a] This estimate is for the full amount of the approximate annual expenditures for this work fixed by Congress in the continuing-contract authorization of March 2, 1907. It is noted that at this rate from thirty-five to forty years will be required to complete the existing project. In his report herewith (Appendix Y 2) the district engineer officer recommends that the next fiscal year appropriation be $1,500,000, and his opinion, that prosecution of this improvement is advisable to a greater extent than has been authorized in recent years, is concurred in.

July 1, 1908, balance unexpended	$16,030.30
June 30, 1909, amount expended during fiscal year, for works of improvement	2,855.72
July 1, 1909, balance unexpended	13,174.58
July 1, 1909, outstanding liabilities	217.80
July 1, 1909, balance available	12,956.78

(See Appendix Y 4.)

5. *Operating and care of Mississippi River improvement at Moline, Ill.*—This lock, which admits boats to Moline and also forms a link in the 6-foot channel improvement of Rock Island Rapids, was formally opened to navigation December 23, 1907. During the past fiscal year the lock was in use 259 days, during which time there passed through it 2,713 boats and 1,132 barges, carrying 46,693 tons of freight and 43,112 passengers. As the lock was in operation only a portion of the previous year, no accurate comparison of traffic can be made.

The draft afforded by the lock is 6 feet at extreme low water. It has an available length of 325 feet and width of 80 feet.

The cost of operating and care of Moline lock is provided for by an indefinite appropriation made by act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909. The expenditures to June 30, 1909, amounted to $14,799.03, of which $10,000 was expended during the past year.

(See Appendix Y 5.)

6. *Operating and care of Milan section of Illinois and Mississippi Canal, Ill.*—This portion of the canal is 4½ miles in length, surmounting a fall of 18 feet, and was formally opened to navigation April 17, 1895. During the past fiscal year the canal was in use 260 days, during which time there passed through it 1,756 boats and 745 barges, carrying 12,512 tons of freight and 9,336 passengers.

The commercial traffic was about the same as that of the previous year.

The draft afforded by the canal is 7 feet.

The locks, 3 in number, have a length of 170 feet between miter sills and a width of 35 feet. The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

The expenditures to June 30, 1909, amounted to $128,730.38, of which $19,700 was expended during the past year.

(See Appendix Y 6.)

7. *Illinois and Mississippi Canal: Improvement of Rock River pool.*—With funds provided from the appropriation for construction of the canal during 1908, suction dredge *Geyser* was employed for one week removing sand to the amount of 4,274 cubic yards from the lower approach to Lock 29 and in Anderson Chute. Drill boat *103* and dipper dredge *Ajax* were employed from September 1 to November 20, 1908, in blasting and removing rock between Lock 29 and Anderson Island and at Hilliers Island. In this work about 3,959 cubic yards of rock and 3,165 cubic yards of sand were removed.

Buoys and channel marks were placed and considerable snagging done.

In 1909 work was resumed in April with drill boat *103* and dredge *Ajax* and was carried on to June 30 at Hilliers Island and below Lock 29. The project for improvement from Lock 29 to Hilliers was changed to give a width of 200 feet and to throw the channel to the south of Andersons Island.

The amount expended on this improvement is $42,399.29, and during the year $22,399.29.

(See Appendix Y 7.)

8. *Operating and care of Galena River improvement, Illinois.*—This improvement, consisting of a lock and dam in the Galena River, was purchased by the United States in March, 1894, under provisions of the act of September 19, 1890, at a cost of $100,000.

During the past fiscal year the lock was open for navigation 235 days, in which time there passed through it 4,750 steamboats, launches, and barges, carrying 16,093 passengers and 15,166 tons of merchandise, which traffic is four times as great in merchandise and about 70 per cent greater in boats than the previous year.

The draft that can be carried at extreme low water is 2 feet, as limited by the depth on the lower miter sill of the lock, which has an available length of 280 feet and width of 52 feet.

The cost of operating and care of the improvement is provided for under an indefinite appropriation made by act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909, and the amount expended to June 30, 1909, is $81,407.44, of which $4,500 was expended during the year.

(See Appendix Y 8.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE ST. PAUL, MINNESOTA, DISTRICT.

This district was in the charge of Maj. Francis R. Shunk, Corps of Engineers. Division engineer, Col. W. H. Bixby, Corps of Engineers.

1. *Mississippi River between St. Paul and Minneapolis, Minn.*—This section of the Mississippi River, from the Chicago, St. Paul, Minneapolis and Omaha Railway bridge in St. Paul to Washington Avenue Bridge in Minneapolis, is 11.4 miles long. Before improvement, boats drawing 3 feet could go up at ordinary low water as far as the mouth of the Minnesota River, 2.66 miles above the Chicago, St. Paul, Minneapolis and Omaha Railway bridge. From the Minnesota River to the present site of Dam No. 2, a distance of 6.56 miles, there was a channel about 2½ feet deep, but on account of the velocity of the current upstream freighting was difficult and unprofitable. From this point to the Washington Avenue Bridge, a distance of 2.18 miles, the depth was not more than 2 feet at ordinary low stage, and the velocity such as effectually to prevent navigation. Before 1894 work was done in this part of the river under allotments from the appropriations for "Improving the Mississippi River from the landing on the west bank below the Washington Avenue Bridge, Minneapolis, to the Des Moines Rapids." A total amount of $59,098.70 was thus expended in dredging, bank protection, and construction of wing dams. As a result considerable improvement was made in the navigable reaches, but the limits of navigation were not extended.

In 1894 a separate project was adopted for the Mississippi River between St. Paul and Minneapolis. It provided for two locks and dams: One (No. 1) just above the mouth of Minnehaha Creek, and 3.68 miles above the Minnesota River, to have a lift of 13.3 feet; another (No. 2), 2.88 miles above No. 1 and 2.18 miles below Washington Avenue Bridge, Minneapolis, to have a lift of 13.8 feet. The lock chambers were to be 80 feet by 334 feet, and the depth on the lower miter sills 5 feet at low water.

This project was modified by the act of March 2, 1907, which requires a channel depth of 6 feet instead of 5 feet. This will make it necessary to increase the lifts of the two dams, and to take measures for increasing the depth on the lower miter sill of Lock No. 1 to 6 feet at low water; but funds for this work have not as yet been provided by Congress.

The river and harbor act approved March 3, 1899, authorized the completion of Lock and Dam No. 2, together with Lock and Dam No. 1, under continuing contracts or otherwise, at a total cost, for both locks and dams, of $1,166,457. An increase in the limit of cost to $1,466,000 was authorized by the river and harbor act approved March 3, 1905. This act authorized continuing contracts for the completion of the work in the sum of $299,543, of which $59,543 still remains to be appropriated.

The amount expended under this project to June 30, 1909, was $1,149,453.47, of which $2,792.43 was for maintenance.

Lock and Dam No. 2 is now completed and has been in operation since May, 1907. Lock No. 1 is completed, except some backfilling, lock gates, and maneuvering machinery, but no work has yet been done on Dam No. 1. The whole project is about 75 per cent completed.

Until the completion of Lock and Dam No. 1, the work can not have much beneficial effect on the navigability of the river.

The river and harbor act approved March 3, 1909, provided for the examination of the river with a view of modifying the project. The item is as follows:

> Mississippi River, from St. Paul to Minneapolis, with a view to modification of project to provide for increased depth and utilizing the surplus water for development of power: *Provided*, That if any modification of the present project be deemed advisable by the Chief of Engineers, no work thereon shall be performed inconsistent with such proposed modifications. The Chief of Engineers shall submit various practical alternative plans with the advantages of each.

A Board of Engineers, consisting of Maj. Charles S. Riché, Maj. Francis R. Shunk, and Maj. Charles S. Bromwell, has been appointed to consider and report upon the proposed modification.

The usual variation of level of water surface is about 8 feet, with a maximum variation of about 16 feet.

The head of navigation for large boats now is the mouth of the Minnesota River, 2.7 miles above the Chicago, St. Paul, Minneapolis and Omaha Railway bridge in St. Paul. The reach from the mouth of the Minnesota River to Minnehaha Creek, a distance of 3.3 miles, is regularly used by light-draft excursion boats.

At the present time the principal commerce is the passage of logs, loose and rafted. During the calendar year 1908, 77,000,000 feet b. m. of logs, approximately 350,000 tons, with an estimated value of $1,694,000, was floated down the river. The excursion business amounts to about $15,000 per annum.

The construction of the two locks and dams will develop a passenger traffic between St. Paul and Minneapolis, and is expected to reduce the freight rate on flour and grain shipped from Minneapolis.

It is proposed to expend the amount estimated as a profitable expenditure during the fiscal year 1911 in completing Lock and Dam No. 1.

July 1, 1908, balance unexpended	$167,423.00
Amount appropriated by sundry civil act approved March 4, 1909	180,000.00
Miscellaneous receipts	17.70
	347,440.70
June 30, 1909, amount expended during fiscal year, for works of improvement	88,056.69
July 1, 1909, balance unexpended	259,354.01
July 1, 1909, outstanding liabilities	1,958.54
July 1, 1909, balance available	257,425.47
Amount (estimated) required for completion of existing project	59,543.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	59,543.00

(See Appendix Z 1.)

2. Operating and care of Lock No. 2, Mississippi River between St. Paul and Minneapolis, Minn.—This lock and dam were completed in 1906, and their maintenance and operation have been provided for since July 1, 1907, by allotments from the appropriation for "Operating and care of canals and other works of navigation."

The amount expended to June 30, 1909, is $7,405.28.

Lock and Dam No. 2 is the first of a series of two between St. Paul and Minneapolis, Minn., the object of which was to provide slack-water navigation over the stretch of river between Minnehaha Creek and the Washington Avenue Bridge, Minneapolis, Minn. No. 2 is the upper one of the series and was constructed first because navigation on the section above was difficult and hazardous under the most favorable conditions, and virtually impossible at low stages of the river.

Since the completion of this lock and dam the river above is navigable up to Washington Avenue Bridge, Minneapolis, for boats drawing 5 feet. Until Lock and Dam No. 1 are completed, however, the full benefit of Lock and Dam No. 2 can not be felt, since the river between the two locks is very difficult of navigation in its present condition.

During the year 77,000,000 feet b. m. of logs passed the dam. The weight of these logs was about 350,000 tons and their value about $1,694,000.

(See Appendix Z 2.)

3. Reservoirs at headwaters of Mississippi River and Mississippi River between Brainerd and Grand Rapids, Minn.—Under this title are included two entirely separate improvements, which are separately considered:

(a) *Reservoirs at headwaters of Mississippi River.*—These works are intended to improve navigable depths on the Mississippi River above Lake Pepin. Before improvement the river was subject to fluctuations of level between wide limits and was often unnavigable at low stages.

The project adopted in 1880 called for the construction of forty-one reservoirs in Minnesota and Wisconsin to collect surplus water from the precipitation of winter, spring, and early summer, and release it systematically during low water so as to benefit navigation on the Mississippi River. The estimated cost, exclusive of land and flowage easements, was $1,809,083.

In compliance with act of Congress of August 5, 1886, the Chief of Engineers, in 1887, recommended that the reservoirs originally contemplated on the St. Croix, Chippewa, and Wisconsin rivers be not constructed. Subsequent acts of Congress have been in accord with this recommendation, and the project is considered as modified to the extent recommended. (See Annual Report of the Chief of Engineers for 1887, pp. 1681 et seq.)

The act of March 2, 1907, authorized the construction of a reservoir at Gull Lake, Minnesota, at an estimated cost of $70,000, provided that the necessary land and flowage easements be acquired without cost to the United States. About one-third of the flowage rights required have been deeded to the United States and the rest are in process of condemnation by private parties for the United States. The same act authorized the reconstruction of Sandy Lake dam, without a lock for steamboats, at an estimated cost of $75,000. This provision was amended by section 5 of an act (Public, No. 153) approved May 28, 1908, by striking out the words "without a lock for steamboats."

The total expenditure up to June 30, 1909, was $1,513,160.21, of which $638,732.56 was for original construction, $484,298.73 for renewal and maintenance, $153,393.11 for acquisition of land and flowage rights, including surveys, and the remainder for operating expenses, damages, and contingencies.

The sum of $258.65 has been received on account of refundments and the sale of material.

Five timber dams were built, at Lake Winnibigoshish, Leech Lake, Pokegama Falls, Pine River, and Sandy Lake. The first four have been rebuilt in concrete, and the building of a new concrete dam at Sandy Lake is now in progress.

Title to 6,122 acres of land has been acquired, and flowage rights on 9,553 acres, including 283 acres for the proposed Gull Lake Reservoir.

Since 1898 operations have been confined to the completion, renewal, and repair of existing works, surveys, and acquisition of necessary land and flowage easements.

The expenditure as a whole has resulted in benefit during the low-water season to the navigable portions of the Mississippi River from Cass Lake, Minn., to Lake Pepin, and incidentally in the mitigation of the floods in the river above St. Paul. The chief benefit has probably been to commerce on the Mississippi River from St. Paul down.

The effect on freight rates has been considerable, both on the upper river and below St. Paul. Without the reservoirs steamboat transportation would scarcely be possible during low water between Brainerd and Grand Rapids, and freight would have to be carried by wagons at great expense. It is a fact that railroad freight from St. Paul to St. Louis, a distance of 600 miles, is only 5 per cent higher than the rate from St. Paul to Chicago, 400 miles; and that steamboat freight rates to river points below St. Paul are in general about one-third lower than those of the railroads. Some portion of this reduction is doubtless due to the reservoirs.

(*b*) *Mississippi River between Brainerd and Grand Rapids, Minn.*—By act of June 13, 1902, this improvement was added to the project for reservoirs. Work of snagging, bowlder removal, etc., had been done on this part of the river under a project (now expired) for "Improving Mississippi River above the Falls of St. Anthony." The present project contemplates continuation of such work. No estimate of cost has been adopted.

Up to June 30, 1909, $19,000.96 had been expended. As a result the channel between Brainerd and Grand Rapids was greatly improved by removal of snags, overhanging trees, bowlders, etc. The maximum draft that can be carried at low water on the Mississippi River above Brainerd depends upon the manipulation of the reservoirs. The amount of water discharged varies with the requirements of navigation, but a depth of 4 feet could probably be maintained throughout the low-water season if necessary. The usual variation in level is about 10 feet. Cass Lake, 283 miles above Brainerd, is the head of navigation.

There are three steamboats and several launches operating on the Mississippi River between Brainerd and Grand Rapids. During the season of 1908 these boats carried about 1,500 tons of miscellaneous freight, of an estimated value of $100,000, and about 1,700 passengers. In addition to the above about 255,000,000 feet b. m. of loose logs and rafts of hard wood, poles, and pulp wood were floated over this section of the river. The combined weight of the last two items was about 1,150,000 tons and the value about $5,100,000.

There are no railroads paralleling the portion of the river under improvement, and inhabitants of the adjacent country are dependent upon the river as a means of transportation. The work of improvement has given a safer and more commodious channel, and has doubtless kept down freight rates on the river.

Under the whole project no additional appropriations are needed for expenditure during the fiscal year ending June 30, 1911. It is proposed to expend the available funds in building a lock at Sandy Lake, building dikes, etc.

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$109,884.51
Amount derived from sales	25.00
	109,909.51
June 30, 1909, amount expended during fiscal year, for works of improvement	46,382.87
July 1, 1909, balance unexpended	63,526.64
July 1, 1909, outstanding liabilities	696.15
July 1, 1909, balance available	62,830.49

RECONSTRUCTION OF SANDY LAKE DAM.

July 1, 1908, balance unexpended	$42,672.55
June 30, 1909, amount expended during fiscal year, for works of improvement	36,658.15
July 1, 1909, balance unexpended	6,014.40
July 1, 1909, outstanding liabilities	460.00
July 1, 1909, balance available	5,554.40

CONSTRUCTION OF GULL LAKE RESERVOIR.

July 1, 1908, balance unexpended	$69,412.68
June 30, 1909, amount expended during fiscal year, for works of improvement	356.24
July 1, 1909, balance unexpended	69,056.44
July 1, 1909, outstanding liabilities	7.00
July 1, 1909, balance available	69,049.44

CONSOLIDATED.

July 1, 1908, balance unexpended	$221,969.74
Amount derived from sales	25.00
	221,994.74
June 30, 1909, amount expended during fiscal year, for works of improvement	83,397.26
July 1, 1909, balance unexpended	138,597.48
July 1, 1909, outstanding liabilities	1,163.15
July 1, 1909, balance available	137,434.33

(See Appendix Z 3.)

4. Operating and care of reservoirs at headwaters of Mississippi River.—Before 1894 the expenses of operation were paid from the appropriations for construction. By act of August 18, 1894, the "care, preservation, and maintenance" of the reservoirs were included under the appropriation for "Operating and care of canals and other works of navigation." Annual allotments have since been made from that appropriation.

The care, preservation, and maintenance of the reservoirs include repairs to dams, dikes, buildings, roads, telephone lines, etc., and the payment of salaries to dam tenders and gauge readers.

The reservoirs are operated mainly with a view to the improvement of navigation on the Mississippi River, but with due regard to other legitimate interests. Incidentally they are of great benefit in mitigating floods and in regulating the flow of water for power purposes. No definite schedule can be determined beforehand, but the following are the general rules observed in operation:

(*a*) The discharge must not, by operation of the reservoirs, be reduced below the normal low-water flow of the streams affected. This rule is necessary in the interest of manufacturers.

(*b*) When logs arrive in the reservoirs they must be sluiced through. Transportation of logs by floating is a form of commerce and the main form of commerce on the streams affected by the reservoirs. It is dangerous to the dams to allow accumulations of logs, so that they must be sluiced through even in times of flood.

(*c*) The winter flow is so regulated as to make room for 39,000,000,000 cubic feet of water at the end of winter. This is the amount ordinarily to be expected in the spring floods.

(*d*) From the spring thaw until the dry season of summer (ordinarily until about July 10) as much water is retained in the reservoirs as possible, subject to rules (*a*) and (*b*).

(*e*) When the gauge at St. Paul has fallen nearly to 3 feet (which reading indicates a channel depth at St. Paul of 5 feet) water is released so as to keep the gauge at this reading. If there is not enough water for this purpose, then the greatest constant depth possible is maintained.

(*f*) When, during the low-water stage, there is not sufficient depth for the steamer plying between Aitkin and Grand Rapids and the quantity of water in the reservoirs is sufficient, enough water is released, on request, to make a trip possible. This use of the reservoirs is occasional.

The total amount expended up to June 30, 1909, was $279,137.46, of which $27,932.08 was expended during the past year. As a result the river has been maintained during the summers of most years at a navigable stage in its upper portion and from St. Paul to Lake Pepin. Flood heights in the Mississippi have been reduced, often by several feet, and the benefit to manufacturing interests, due to the more uniform flow, has been very great.

For capacities of reservoirs, maps of region, and comparison of rainfall and run-off, see Annual Reports of the Chief of Engineers for 1896, page 1841, and for 1905, page 1678. For break in Pine River reservoir, see Annual Reports of the Chief of Engineers for 1896, page 1844, and for 1897, page 2144. For diagrams showing how much water had been stored each year in each reservoir, see Annual Report of the Chief of Engineers for 1900, Part 4, page 2798. For distribution of liabilities incurred during the fiscal years 1898 to 1905, see Annual Report of the Chief of Engineers for 1905, pages 1676–1677. For report of Board of Engineers upon matters connected with the operation of the reservoirs, see Annual Report of the Chief of Engineers for 1906, Part 2, page 1443.

(See Appendix Z 4.)

5. *St. Croix River, Wisconsin and Minnesota.*—Before improvement the ruling low-water depth on the bars above Lake St. Croix was 2 feet. In Lake St. Croix the channel was in most places 8 to 10 feet deep, but narrow and tortuous.

The project was adopted in 1875, and amended as to estimates of cost in 1882 and 1889. By act of June 3, 1896, the improvement of the harbor and water front of Stillwater was added to the project.

The end sought was to provide a commodious channel 3 feet deep at low water from Taylors Falls to the Mississippi River, a distance of 52.3 miles, and to give adequate harbor facilities at Stillwater. This was to be done by means of dredging in Lake St. Croix and at Stillwater and by dredging and contraction works above Lake St. Croix. The estimate of cost, as finally modified, was $136,700. The project was completed in 1900.

Since that time work of maintenance has been done. The appropriations have not been sufficient to accomplish all that was desired, and the channel above Lake St. Croix has deteriorated so as to be scarcely navigable at low stages. This deterioration is mainly due to the choking of the river by snags and sunken logs.

The amount expended to June 30, 1909, was $147,694.86, of which the amount spent since 1900, $16,285.36, was for maintenance only.

Regular appropriations of $3,600 per annum are needed for the maintenance of this improvement.

The maximum draft that could be carried June 30, 1909, at low water was 3 feet at and below Stillwater. Above Stillwater it was not more than 2 feet. Taylors Falls, about 52 miles from its mouth, is the head of navigation on this stream. The usual variation of level of water surface is about 6 feet.

The commerce of this river is chiefly in logs, which are floated loose to Stillwater, Minn., and rafted below that place. About 84,000,000 feet b. m. of loose logs were floated during the season of 1908, their weight being about 378,000 tons and their value about $1,848,000. About 43,000,000 feet b. m. of logs and manufactured lumber, 4,000,000 laths, and 6,000,000 shingles were rafted below Stillwater, 10 steamboats being engaged in these operations. One steamboat made daily trips during the season between Osceola and Taylors Falls, Minn., carrying passengers and a little freight, but no information could be obtained of the amount of business done. No freight to speak of has been carried on the river in recent years. The work done has had no effect on freight rates.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year 1911 to dredging and the repair of wing dams, such work being necessary to make previous improvements available.

Reports on examinations of this river have been published as follows: Ordered by act of June 23, 1874, Executive Document No. 75 (part 6), Forty-third Congress, second session; report dated January 26, 1880, Report of the Chief of Engineers for 1880, page 1661; ordered by river and harbor act of September 19, 1890, Annual Report of the Chief of Engineers for 1891, page 2218; ordered by river and harbor act of March 3, 1899, Annual Report of the Chief of Engineers for 1900, page 2837; ordered by river and harbor act of March 3, 1905, House Document No. 686, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended	$397.74
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,600.00
	3,997.74
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	727.60
July 1, 1909, balance unexpended	3,270.14
July 1, 1909, outstanding liabilities	585.29
July 1, 1909, balance available	2,684.85
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	4,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Z 5.)

6. *Minnesota River, Minnesota.*—Before improvement the ruling low-water depth at the entrance to Minnesota River was not more than 2 feet. From the mouth to Shakopee, a distance of 23.7 miles, there was a least low-water depth of 7 feet, and from Shakopee to Little Rapids, 11.8 miles, a least depth of 3 feet. From Little Rapids to Mankato, a distance of 78.2 miles, the river was navigable only at the higher stages. Above Mankato navigation was possible only at very high water. Along the entire course the channel was obstructed by bowlders, snags, and overhanging trees.

The project, adopted in 1867, provided for the removal of snags, bowlders, etc., from Yellow Medicine River to the mouth, a distance of 237 miles. The estimate of cost was $117,000. In 1893 the project was modified to include the construction of a low-water dam across the mouth of the river at Pike Island, and the excavation of a new channel through Fort Snelling Chute at the head of Pike Island. When the Minnesota River is low, the Mississippi River, at the head of Pike Island, is ordinarily higher than the Minnesota, and the object of the dam and new channel was to raise the level of the Minnesota at and near Little Rapids during low stages as well as to provide a better entrance. The estimated cost of the new work was $10,000. The project was completed in 1895. Work done since that time has been in maintenance of the channel at the mouth.

By act of June 13, 1902, $2,500 was appropriated for the removal of the dam at Pike Island, should the Secretary of War in his discretion so determine. The dam was removed in 1908.

Amount expended to June 30, 1909, was $139,438.02, of which $7,938.77 was for maintenance of existing improvements.

Appropriations since 1896 have been very small and irregular and have all been applied to the maintenance of the improvement at the mouth of the river, for which purpose they have not been sufficient.

Regular appropriations of $2,000 per annum are needed for the maintenance of this improvement.

The maximum draft that could be carried to Shakopee June 30, 1909, at low water was 5 feet, great improvement in the navigable depth at the entrance having resulted from the removal of the dam at Pike Island.

Little Rapids, 36 miles from the mouth, may be considered the head of navigation at present, although at high stages navigation is possible to Le Sueur, 88 miles from the mouth.

The stream is at present used chiefly by excursion steamers and small pleasure launches. A small freight boat ran between St. Peter and Mankato during the season of 1909, but no statistics could be obtained.

The Minnesota River has as yet had no effect on freight rates, as until this season vessels of commercial size have not been able to enter it.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year 1911 to dredging the river from its mouth to about 2 miles above.

For historical sketches see Annual Report of the Chief of Engineers for 1879 and 1894, pages 1182 and 1725, respectively.

For description and physical characteristics see Report of the Chief of Engineers for 1875, page 381. Reports of examinations have been published as follows: Executive Document No. 76, Forty-third Congress, second session; Executive Documents Nos. 249 and 1335, Fifty-third Congress, second session; Report of the Chief of Engineers for 1895, pages 2206 and 2208; Report of the Chief of Engineers for 1897, page 1834; Report of the Chief of Engineers for 1900, page 2834; Report of the Chief of Engineers for 1904, page 2260; House Document No. 493, Sixtieth Congress, first session.

REMOVING DAM NEAR MOUTH.

July 1, 1908, balance unexpended	$2,500.00
Amount carried to the surplus fund of the Treasury	21.32
	2,478.68
June 30, 1909, amount expended during fiscal year, for works of improvement	2,478.18
July 1, 1909, balance unexpended	.50
July 1, 1909, outstanding liabilities	.50

REMOVING BAR AT MOUTH.

July 1, 1908, balance unexpended	$1,894.93
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	3,894.93
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,354.77
July 1, 1909, balance unexpended	2,540.16
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,200.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CONSOLIDATED.

July 1, 1908, balance unexpended		$4,394.93
Amount allotted from appropriation by river and harbor act approved March 3, 1909		2,000.00
		6,394.93
Amount carried to the surplus fund of the Treasury		21.32
		6,373.61
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,478.18	
For maintenance of improvement	1,354.77	
		3,832.95
July 1, 1909, balance unexpended		2,540.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		2,200.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix Z 6.)

7. *Red River of the North, Minnesota and North Dakota.*—Under this project are included the improvement of the Red River of the

North, Minnesota and North Dakota, and of Red Lake River, Minnesota.

Before improvements the ruling depth at low water in the Red River of the North from the Canadian frontier to Grand Forks, a distance of 143.5 miles, was 2 feet, and from Grand Forks to Moorhead, 155 miles, 1.5 feet. From Moorhead to Breckenridge, 97 miles, navigation was possible only at the higher stages. The river was obstructed by snags, overhanging trees, etc.

Red Lake River from the head of Red Lake to Thief River Falls, a distance of 135 miles, had a low-water depth of at least 3 feet in most places, but was obstructed by a bar at the mouth of the lake and by bowlders between Thief River Falls and High Landing, a distance of 35 miles, so that the ruling depth was 1.5 feet.

The project for the Red River, adopted in 1878, provided for dredging and removal of obstructions from Breckenridge to the international boundary, and the construction of a lock and dam to overcome the fall at Goose Rapids, the whole being with a view to obtain channels as follows:

Breckenridge to Moorhead, 97 miles, a channel capable of being navigated during high and medium stages of water.

Moorhead to Grand Forks, 155 miles, a channel 50 feet wide and 3 feet deep at low water.

Grand Forks to the northern boundary line, 143.5 miles, a channel 60 feet wide and 4 feet deep at low water.

The estimated cost was $364,598.17. This project was modified as follows: In 1883 the estimated cost was increased to $398,598.17. In 1887 the proposed lock and dam at Goose Rapids was dropped from the project and the estimate reduced to $252,598.37. In 1893 the estimate was increased to $310,320.

The improvement of Red Lake River was added to the project in 1896. It was proposed to provide a depth of 3 feet by dredging and removal of bowlders from Thief River Falls to the head of Red Lake. The amount authorized by Congress to be spent on this work was $9,000. The total estimate for both rivers is therefore at present $319,320.

The total amount expended to June 30, 1909, was $339,542.81, of which $37,129.21 was for maintenance. The sum of $159.50 has been returned to the appropriation by the sale of condemned material.

As a result of these expenditures some improvement was made in the few years subsequent to 1878 in the upper section of the river. No work has been done in this section in recent years because there has been no navigation. In the middle section the project was completed, except for 13 miles, in 1894. Since that time the river above Bellmont, N. Dak., has been obstructed by unauthorized bridges which do not permit navigation. In the lower section the project was completed in 1902.

Since the shoals in this river constantly recur, annual work of maintenance is necessary. The funds supplied not having been sufficient to maintain depths contemplated by the project, the navigable depth of the middle section is now 2 feet and of the lower section 3.5 feet. Nothing beyond work of maintenance has been done in recent years; this has been confined to dredging the worst bars in the vicinity of Grand Forks, N. Dak. The expenditure of at least $7,500 annually would be required to keep the navigated portions of the river in condition.

On Red Lake River work has been confined to the removal of snags, bowlders, and similar obstructions from the channel. No work has been done since 1900, and in 1905 the floating plant used for this work was sold by authority of the Secretary of War.

The actual head of navigation on the Red River of the North is Bellmont, N. Dak., about 180 miles by river from the international boundary. The usual variation of water surface is 25 feet; the maximum variation 49 feet.

Red Lake River is navigable from Thief River Falls to the head of Red Lake, a distance of 135 miles. Below Thief River Falls the river is not navigable. The usual variation of level is about 3.5 feet; the maximum variation about 6 feet.

Red River is regularly used during the summer season by 2 steamboats and 12 barges. During 1908, 12,026 tons of wheat were carried from river points to Grand Forks for transfer to railroads.

Four steamers and 1 launch make use of the Red Lake River, carrying passengers and small amounts of freight. About 60,000,000 feet b. m. of logs were floated down Red Lake River during the season of 1908, their weight being 270,000 tons and their value $1,320,000.

In addition to the above about 400 tons of miscellaneous freight and about 1,000 passengers were carried.

Rates on the Red River steamers are from 70 to 50 per cent less than the railroad rates between common points.

This project has no apparent effect on railroad freight rates.

It is proposed to apply the amount estimated as a profitable expenditure for the fiscal year 1911 in dredging near Grand Forks, N. Dak.

For physical characteristics see Annual Reports of the Chief of Engineers for 1874, page 295; 1875, page 370; 1878, page 730; 1879, page 1192. For plans of improvements see Annual Reports of the Chief of Engineers for 1874, page 297; 1879, page 1191; 1881, page 1757. For revisions of projects see Annual Reports of the Chief of Engineers for 1883, page 1450; 1887, page 1712. For description of large landslide caused by Northern Pacific Railroad embankment, see Annual Report of the Chief of Engineers for 1898, page 1831. References to reports on examinations ordered by the river and harbor acts of March 3, 1905, and March 2, 1907, will be found in the Annual Report of the Chief of Engineers for 1906, Part 1, page 483, and in the Annual Report of the Chief of Engineers for 1908, Part 1, page 542.

July 1, 1908, balance unexpended	$5,024.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	7,500.00
	12,524.80
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	5,785.11
July 1, 1909, balance unexpended	6,739.69
July 1, 1909, outstanding liabilities	701.18
July 1, 1909, balance available	6,038.51
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	7,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Z 7.)

8. *Warroad Harbor and Warroad River, Minnesota.*—Before improvement there was a good natural harbor of moderate depth at the mouth of Warroad River. Between the harbor and the river there was a bar having a least depth of 3.5 feet at ordinary lake stage (7.2 feet on the gauge) and between the harbor and the lake a bar having a least depth of 5 feet at ordinary lake stage. The channel of the Warroad River from the harbor to the steamboat landing (about 1 mile) was deep but tortuous.

The river and harbor act of 1899, as amended by the act approved June 6, 1900, appropriated $3,000, or so much thereof as might be necessary, for improving the mouth of Warroad River, Minnesota. Nothing was done under this appropriation beyond making an examination and survey.

The present project was adopted in 1902, and provided for building a dredge and dredging in the harbor a channel sufficient for boats drawing 7 feet of water. The estimated cost was $45,000. This project was modified in 1905 so as to provide for a channel 100 feet wide and 7 feet deep from the inner end of the harbor channel to the boat landing at Warroad, with a turning basin for boats at the inner end, at an estimated cost of $35,000. The total estimate is therefore $80,000.

The total amount expended to June 30, 1909, was $84,854.93, of which $16,532.97 was for work of maintenance. As a result the turning basin was completed, the inner channel dredged for a distance of 4,000 feet to a width of 100 feet and a depth of 9 feet at ordinary stage, and for a distance of 1,800 feet to a width of 200 feet and a depth of 9 feet. The outer channel had been dredged from the harbor to the lake, a distance of 5,400 feet, to a width of 200 feet and a depth of 12 feet. The maximum draft that can be carried is 8 feet at a stage of 7.2 feet on the lake gauge. This is sufficient for any boat now using the Lake of the Woods.

The head of navigation on Warroad River is at the steamboat landing, about a mile above the mouth.

The bars in this harbor are formed by wave action, and constantly recur. Annual dredging is therefore necessary for maintenance. It is estimated that $4,000 should be expended each year in work of maintenance.

During the season of 1908 the commerce amounted to 2,600 tons of miscellaneous freight. Boats using the harbor carried about 7,700 passengers. The value of the business done could not be obtained.

This improvement has no effect on railroad freight rates. There are no railroads in competition with steamers on the lake.

July 1, 1908, balance unexpended		$1,839.64
Amount allotted from appropriation by river and harbor act approved March 3, 1909		4,000.00
Amount allotted from emergency appropriation, river and harbor act approved March 2, 1907		4,000.00
		9,839.64
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,200.00	
For maintenance of improvement	1,904.00	
		3,104.00
July 1, 1909, balance unexpended		6,735.64
July 1, 1909, outstanding liabilities		727.86
July 1, 1909, balance available		6,007.78

(See Appendix Z 8.)

9. Survey of Otter Tail Lake and Otter Tail River and Red Lake and Red Lake River, Minnesota, and of Big Stone Lake and Lake Traverse, Minnesota and South Dakota.—The river and harbor act approved June 13, 1902, provided for the continuation of these surveys, which were ordered by Congress with a view to the construction of reservoirs for the improvement of the navigation of Red River of the North and Minnesota River.

Preliminary reports were submitted in April, 1900, and are printed in the Annual Report of the Chief of Engineers for 1900, pages 2828–2836. A final report was submitted August 11, 1903, and printed in the Annual Report of the Chief of Engineers for 1904, page 2260 et seq.

Amount expended on all projects to June 30, 1909, $17,293.28.

It is proposed to reserve the available funds for the purpose of making hydrological observations during the next flood affecting these localities.

July 1, 1908, balance unexpended	$8,206.72
July 1, 1909, balance unexpended	8,206.72

(See Appendix Z 9.)

10. Gauging Mississippi River at or near St. Paul, Minn.—This work is provided for by allotment from the permanent annual appropriation of $9,600 made by the river and harbor act of August 11, 1888, as amended by section 9 of the river and harbor act of June 13, 1902, for the purpose of securing the uninterrupted gaugings of the waters of the Mississippi River and its tributaries. No gaugings were made until the fall of 1899. Since then gaugings have been made as frequently as the funds available would permit and the conditions justified the expenditure. For location of gauges see map facing page 1832, Report of the Chief of Engineers for 1898.

Tables showing relation of rainfall to run-off in the Mississippi Valley above St. Paul are printed on page 2169, Report of the Chief of Engineers for 1897. The slope of the Mississippi River between Minneapolis and St. Paul is shown in the Report of the Chief of Engineers for 1900, page 2823.

The amount expended to June 30, 1909, is $7,702.53.

(See Appendix Z 10.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE KANSAS CITY, MISSOURI, DISTRICT.

This district was in the charge of Maj. E. H. Schulz, Corps of Engineers. Division engineer, Col. W. H. Bixby, Corps of Engineers.

1. Missouri River.—General improvement.—The Missouri River has been navigated by steamboats since 1819; first boat to Council Bluffs, 1819; first to mouth of the Yellowstone, 1832; first to head of navigation, Fort Benton, Mont., 1859. The length of navigable river from Fort Benton to mouth is 2,284.8 miles. Some portions of the river above the Great Falls are also navigable.

The original condition of the river was, and to a great extent the present condition is, one of alternate pools and bars. The low-water depth over bars is about 3 feet and the width of the river at such places is from one-third to 1 mile. In the deep reaches the width is 800 to 1,500 feet and the low-water depth in such places is often over 12 feet. Generally speaking, the navigable low-water depth of unimproved river is 3 feet and of high water only 9 feet. The navigable depth does not increase as rapidly as the water height, since the bars rise with the stage of river. The river is also encumbered with snags, which, however, are getting fewer, due to constant snagging operations.

No project for the improvement of the river as a whole has been adopted.

Government work on the river in the matter of removal of snags began as early as 1838 and continued thereafter, under annual appropriations (for the most part made jointly for the Ohio, Mississippi, Missouri, and sometimes the Arkansas rivers), with occasional intermissions, for the next forty years. Prior to 1878 one or two small appropriations had been made for general improvement, but it was with the act of June 18 of the latter year that appropriations began on a large scale.

The work prior to 1884 was carried on under separate districts.

A project for the river from Sioux City to the mouth was adopted in 1884, the improvement to consist of rectification, revetment, and snagging. In 1890 the project was modified by systematic improvement of the first reach, from Jefferson City to the mouth.

From 1884 to 1890 the work on the entire river was under the Missouri River Commission. After 1890 that portion above and including Sioux City, Iowa, was under a separate district until 1902. Since the discontinuance of the Missouri River Commission the works on the entire river have been consolidated under one district.

The greater part of the work on the portion of the river below Sioux City has been done by the Missouri River Commission, reporting to the Chief of Engineers. The commission was constituted by act of Congress of July 5, 1884, and was abolished by the river and harbor act of June 13, 1902.

On the portion of the river above Sioux City the work has been done under the immediate charge of officers of the Corps of Engineers, except during the period from 1884 to 1890, when it was in the charge of the Missouri River Commission. The effort of the commission in its work below Sioux City was to accomplish a continuous, progressive control of the river, contracting it where necessary, giving the channel proper direction, and securely holding it in place. Work in this direction was done in the vicinity of Kansas City and on the first reach of the river, which extends from near Jefferson City to the mouth. On 45 miles of this reach a continuous channel of not less than 6 feet in depth at low water was obtained on what was originally one of the worst parts of the river, in the vicinity of the mouth of the Osage. In addition to forming a channel, much new land was formed and much land protected from destruction by the river. The greater part of the funds appropriated for expenditure under the direction of the Commission was not applicable to the comprehensive plan of improvement adopted, and about one-third of it was diverted to work at separate localities.

On the upper portion of the river the work originally consisted mainly in improving the shoals and rapids on the so-called "Rocky River" from Fort Benton downstream for 150 miles. In recent years it has largely been limited to channel regulation and bank protection at the following points: Williston and Bismarck, N. Dak.; Pierre, Yankton, and Elk Point, S. Dak.; and Sioux City, Iowa. Two ice harbors have been established, one at Rockhaven, N. Dak., the other in the mouth of the Big Sioux River, just above Sioux City.

Works of channel regulation have also been built in the Long Pool, or the reach of the river from the crest of the Great Falls to Cascade, and a small amount of open-river work in the steeper stretch from Cascade to Stubbs Ferry.

In addition to the foregoing work a fleet of snag boats has been in operation clearing the channel of snags and other obstructions on the portion of the river where boats have been running. This work is considered to be directly beneficial to navigation.

The total of appropriations for the river, and of receipts from other sources, from the mouth to Sioux City, including snagging, beginning with the act of June 18, 1878, is $9,402,833.25.

The total of the appropriations and of receipts from other sources for improvements of the upper river, including snagging, beginning with the act of August 14, 1876, is $2,288,807.47.

The total of appropriations for improving Missouri River from mouth to Fort Benton, Mont., $555,000.

Grand total of all appropriations and receipts from other sources, $12,246,640.72.

Total expenditures on account of examinations, surveys, and contingencies, rivers and harbors, $1,031.65.

The total expenditures for all purposes have been $11,604,800.19.

The result of these expenditures has been to demonstrate the possibility of regulating the river in such manner as to make it navigable for a channel of commerce; that the cost of such regulation would be very great, and that no permanent good to navigation can be accomplished by appropriations for specific localities not so connected as to form part of the systematically improved reaches. The result of the expenditures at separated localities has been beneficial locally by protecting the banks and forming good navigable water fronts and incidentally preserving private property from the ravages of the river, but has given little, if any, encouragement to through navigation.

At the localities under improvement an effort has been made to maintain the existing and prevailing depth of channel. The least depth at mean low water over the shoalest part at the localities under improvement is not less than 6 feet. The usual variation of level of water is about 19 feet at Kansas City, 8 feet at Fort Benton, and 25 feet at St. Charles.

The maximum draft June 30, 1909, at mean low water from Kansas City to mouth is 4 feet, from Kansas City to Sioux City 3½, and from Sioux City to Fort Benton 3 feet. The head of navigation is Fort Benton, 2,285 miles above the mouth. Above this point rapids begin, which at Great Falls are a series of falls, the aggregate fall being 500 feet. Above Great Falls, there is a navigable depth practically to Three Forks.

The effect of the improvement has been to equalize and keep down freight rates, the actual river rates being about 60 per cent of the railroad rates.

A condensed description of the works on the river executed under the supervision of the Missouri River Commission is given in the

Commission's last annual report (Annual Report of the Chief of Engineers for 1902, Supplement).

A condensed description of the work above the Great Falls will be found in the Annual Report of the Chief of Engineers for 1899, pages 385–386, and in later annual reports; and of the work on the river between Fort Benton and Sioux City in the Annual Report of the Chief of Engineers for 1902, pages 382–385.

A complete survey of the river has also been made, in part by the Commission and in part by officers in charge of the districts on the upper portions of the river, and has been published in 83 maps, scale 1 inch to the mile.

The river formerly carried an active commerce, which at one time had been entirely diverted to other channels. This commerce now shows healthy signs of reviving.

Commerce has increased greatly on the lower river from Kansas City to the mouth during the season of 1908. Two boats regularly ran from Kansas City to St. Louis, each making a round trip every eight to ten days, and averaging a round trip cargo of 600 tons. There is also a boat running from Jefferson City to St. Louis, and several boats plying between Osage River and St. Louis. A million dollar boat line is now being organized at Kansas City for the purpose of placing a modern boat service upon the river from Kansas City to St. Louis, with proper wharfage and terminal facilities.

Increased commerce and use of the river is also observed in the upper river in the vicinity of Bismarck, N. Dak., and above to the mouth of Yellowstone River.

The character of upstream cargoes is merchandise and general supplies; downstream, grain and stock.

Amount of freight carried on the Missouri River from mouth to Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons.
1897	391,029	1903	750,291
1898	319,793	1904	455,000
1899	263,114	1905	343,435
1900	277,306	1906	573,348
1901	569,666	1907	843,863
1902	410,527	1908	541,144

Amount of freight carried on the Missouri River above Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons.
1887	13,961	1898	26,896
1888	12,895	1899	23,041
1889	16,723	1900	27,179
1890	14,072	1901	37,340
1891	14,211	1902	31,070
1892	17,292	1903	37,994
1893	19,481	1904	28,951
1894	37,936	1905	52,956
1895	21,264	1906	43,987
1896	10,368	1907	45,123
1897	17,105	1908	17,517

Previous reports.—For reports of examinations and surveys above Sioux City, see page 71, list of preliminary examinations and surveys, Document No. 421, Fifty-Seventh Congress, second session. The examinations made above Sioux City were generally for local points.

For reports below Sioux City, see page 110, same document. For list of projects, see pages 182 and 184, same document.

A report covering the entire stretch from Sioux City to the mouth was made February 2, 1881, by Major Suter, found in Annual Report of the Chief of Engineers for 1881, page 1649.

There is no existing project, except the use of such limited funds as have been appropriated since 1902 for purposes of snagging and emergency dike and revetment work. A new project and estimate of cost for improvement for 6-foot and 12-foot channel from Sioux City to Kansas City and Kansas City to mouth, called for by act of Congress March 2, 1907, was submitted April 30, 1908, and transmitted to Congress. (See H. Doc. 1120, 60th Cong., 2d sess.)

During the past year work has been in the main confined to repair work and snagging. New work was done as follows:

Extensive dike work was completed at Elwood, Kans., to prevent the river from leaving St. Joseph, Mo., and to protect banks and railroad bridge at Elwood. Half the cost of this work ($50,000) was contributed by the railroads concerned.

Dike construction was also done at Mokane, Mo., Atherton, Mo., and Elwood, Kans. At Williston, N. Dak., 3,075 feet of revetment was placed at a cost of $11,416.30 to the Government, the Great Northern Railway and the city of Williston furnishing the rock and brush, estimated at $25,000.

Extensive revetment work was also done by the Wabash Railway and by the Chicago and Northwestern Railway below Sioux City, and by the Chicago, Milwaukee and St. Paul Railroad Company above Sioux City.

A public hearing was held at Omaha, Nebr., on September 11, 1908, on the subject of harbor lines, approved by the Secretary of War June 5, 1909.

The act of March 3, 1909, for preservation and repair of river and harbor works, appropriated the following:

Missouri River, mouth to Fort Benton:	
Plant and boat yards	$155,000
Dikes and revetments	400,000

Preliminary examinations of certain localities are being made in compliance with the act of March 3, 1909, reports on which will be submitted to Congress at its next session.

By act of Congress, February 16, 1909, the Secretary of War was authorized to establish harbor lines on the Kansas River at Kansas City, Kans., and preparations for this work are now being made.

The amounts estimated as profitable expenditure for the fiscal year ending June 30, 1911, will be applied to snagging and repair and construction of dikes and revetments, being for maintenance of improvement as well as extension of benefits.

IMPROVING MISSOURI RIVER FROM STUBBS FERRY, MONTANA, TO SIOUX CITY, IOWA.

July 1, 1908, balance unexpended		$5,804.69
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,437.72	
For maintenance of improvement	1,959.58	
		3,397.30
July 1, 1909, balance unexpended		2,407.39

IMPROVING MISSOURI RIVER FROM MOUTH TO SIOUX CITY, IOWA.

July 1, 1908, balance unexpended	$17,955.95
Amount received from sale of maps	16.37
Amount received by deposit Isthmian Canal Commission	61.23
Amount received by overpayment of vouchers	24.63
	18,058.18
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	15,352.73
July 1, 1909, balance unexpended	2,705.45
July 1, 1909, outstanding liabilities	690.95
July 1, 1909, balance available	2,014.50

IMPROVING MISSOURI RIVER.

July 1, 1908, balance unexpended		$231,859.20
Received from services rendered by snag boats		399.49
Received from overpayment of vouchers		23.40
		232,282.09
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$77,976.65	
For maintenance of improvement	83,406.44	
		161,383.09
July 1, 1909, balance unexpended		65,293.04
July 1, 1909, outstanding liabilities		13,453.36
July 1, 1909, balance available		41,839.68

EMERGENCIES IN RIVERS AND HARBORS (MISSOURI RIVER AT ELWOOD, KANS.).

July 1, 1908, balance unexpended	$18,970.09
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	9,968.81
July 1, 1909, balance unexpended	9,001.28

IMPROVING MISSOURI RIVER AT ELWOOD (CONTRIBUTIONS).

July 1, 1908, balance unexpended	$13,320.31
June 30, 1909, amount expended during fiscal year, for works of improvement	13,290.61
July 1, 1909, balance unexpended	29.70
July 1, 1909, outstanding liabilities	29.70

IMPROVING MISSOURI RIVER FROM MOUTH TO FORT BENTON, MONT., PRESERVATION AND MAINTENANCE OF RIVER AND HARBOR WORKS.

Amount allotted from appropriation by river and harbor act approved March 3, 1909	$555,000.00
June 30, 1909, amount expended during fiscal year, for works of improvement	2,525.47
July 1, 1909, balance unexpended	552,474.53
July 1, 1909, outstanding liabilities	26,413.02
July 1, 1909, balance available	526,061.51
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	350,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix AA 1.)

2. *Osage River, Missouri.*—A history of the work of improvement on this river, from the adoption of the original project in 1871 to the end of the fiscal year 1900, was published in the Annual Report of the Chief of Engineers for 1900, page 4944.

The original condition was one of alternate pools and shoals.

The work has been carried on under two projects—that of open-channel improvement, by the construction of cross and wing dams, in addition to dredging and removal of obstructions to navigation, such as snags, etc., and the construction of a lock and dam 7 miles above the mouth of the river.

The removal of obstructions under the first project contemplates maintenance. The obstructions will form anew, and while the cross and wing dams have a degree of permanency, they must receive frequent repair and extension to keep up their efficiency.

The amount expended by the General Government upon both projects up to June 30, 1909, is $800,939.82.

During the past year work on the general river has consisted in dredging, snagging, and repairs to longitudinal and cross dikes.

By act of March 2, 1907, the sum of $10,000 was appropriated for general improvement, and $68,000 was appropriated for continuing construction of Lock and Dam No. 1, with authority for contracts to the additional amount of $160,000, all of which has been appropriated for completion of the lock and dam.

The sundry civil act of March 4, 1909, appropriated $60,000 for the completion of the lock and dam.

The river and harbor act of March 3, 1909, appropriated $10,000 for the Osage River, for maintenance of general open-river improvement.

During the past year work has consisted in additional protection to the piers Nos. 6, 7, 8, and 9, and weirs 7, 8, 9, and 10. The gap between piers 1 and 6 is to be closed by a chanoine wicket dam, 36 feet of which has been completed.

During the past year work has been completed on the lock and dam as follows:

Protection of the foundation of the outer lock wall. Protection of the foundations of piers 7, 8, 9, and 10. The foundation of the dam throughout was reinforced by a deposit of 3 feet of concrete tamped around piling and up to floor for weirs.

Twelve air tanks installed in each of the four weirs in sections 7, 8, 9, and 10 and a 2-inch air pipe with flexible joint connected with each weir.

Thirty-six linear feet of the chanoine dam foundation completed.

Expenditures during the year:

Labor and services	$32,172.10
Material	16,527.75
Freight	3,301.01
	52,000.86

The work now in progress contemplates the completion of the chanoine dam foundation and installation of the wickets and eventual replacing of the wooden lock gates with steel ones.

The funds on hand and available will be applied to the completion of Lock and Dam No. 1, and to maintenance.

It is proposed to use the amount that can be profitably expended in fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, for works of improvement, and for maintenance of general improvement, including snagging, dredging, and repairs to dikes.

The head of navigation is Warsaw, Mo., 172 miles above the mouth. Prior to improvement light-draft boats had to abandon their trips because of shoals; the same boats now ascend to the head of navigation without interference.

The improvement has only influenced freight rates by affording shippers a regular means of transportation by boat.

Previous reports.—Preliminary examinations August 22, 1884, and December 10, 1886. Reports of surveys December 28, 1870, February 11, 1875, February 13, 1879, April 21, 1881, January 9, 1890, November 9, 1900. Project adopted in 1871; snagging, dredging, and wing dams modified in 1890 by one lock and dam near mouth.

Report on preliminary examination and survey, made in compliance with act of March 2, 1907, was made January 21, 1908 (H. Doc. 960, 60th Cong., 1st sess.)

Amount of freight carried on the Osage River.

Calendar year—	Tons.	Calendar year—	Tons.
1895	76,706	1902	95,194
1896	72,393	1903	38,501
1897	71,247	1904	35,746
1898	84,286	1905	8,678
1899	76,702	1906	20,506
1900	96,144	1907	31,601
1901	72,339	1908	30,606

July 1, 1908, balance unexpended		$152,357.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
Amount appropriated by sundry civil act approved March 4, 1909		60,000.00
		222,357.50
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$3,362.05	
For maintenance of improvement	64,603.44	
		67,965.49
July 1, 1909, balance unexpended		154,392.01
July 1, 1909, outstanding liabilities		18,499.94
July 1, 1909, balance available		135,892.07
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix A A 2.)

3. Gasconade River, Missouri.—This river is similar to the Osage, consisting of alternate shoals and pools. The project for the improvement of this stream, adopted in 1880, consisted in the removal of snags and logs from the channel and of leaning timber from the banks of the river, where necessary, and the construction of wing dams and training walls to concentrate the flow of water upon the shoals to increase the depth over them.

From the nature of the project, which contemplates maintenance and relief from year to year and the removal of obstructions which are constantly forming anew, no definite time can be fixed for its completion. The improvement must therefore be continuous.

During the past season the boating channel was cleared of snags and wreck heaps and all overhanging trees were trimmed or felled.

The river and harbor act of March 3, 1909, appropriated $15,000 for the Gasconade River for maintenance of general open-river improvement.

The total of the appropriations and of receipts from other sources for the improvement of Gasconade River, beginning with the act of June 14, 1880, is $126,624.31.

The amount expended under the project to June 30, 1909, is $110,894.19.

The only influence the improvement has had upon freight rates is to afford shippers a regular means of transportation by boat.

It is proposed to use the amount that can be profitably expended in fiscal year ending June 30, 1911, in addition to the balance unexpended July 1, 1909, for works of improvement in continuing present project, which is indefinite, including plant to carry on work, and for maintenance of existing works.

The head of navigation is Arlington, Mo., and the number of navigable miles is 107. Prior to improvement light-draft boats were compelled to abandon their trips because of shoals; the same boats now go to the head of navigation without interference.

Amount of freight carried on the Gasconade River.

Calendar year—	Tons.	Calendar year—	Tons.
1895	47,544	1902	44,380
1896	46,294	1903	10,788
1897	30,515	1904	14,791
1898	30,981	1905	29,837
1899	24,259	1906	27,604
1900	51,580	1907	50,083
1901	19,460	1908	28,887

Previous reports: Reports of previous surveys, February 14, 1873, Annual Report Chief of Engineers, page 479, 1873; February 11, 1880, Annual Report Chief of Engineers, page 1462, 1880; June 30, 1896, Annual Report Chief of Engineers, page 3800, 1896. Notes on river also found on page 3539, Annual Report Chief of Engineers, 1898.

Report on preliminary examination and survey, made in compliance with act of March 2, 1907, was made February 24, 1908 (H. Doc. 829, 60th Cong., 1st sess.).

July 1, 1908, balance unexpended	$2,158.16
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	17,158.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,428.04
July 1, 1909, balance unexpended	15,730.12
July 1, 1909, outstanding liabilities	1,156.64
July 1, 1909, balance available	14,573.48

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	$20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix A A 3.)

4. Fort Riley Military Reservation, Kans.—The sundry civil act of March 4, 1909, appropriated $25,000 for bank preservation at Fort Riley, Kans., as follows:

> Fort Riley Military Reservation, Kansas: For the preservation of the bank line of Republican River in front of the Fort Riley Military Reservation, by revetment and such other work as may be necessary to protect the said reservation from damage by erosion, twenty-five thousand dollars, to be immediately available.

Preliminary examination has been made and project will be submitted and work begun as soon as the present high water subsides.

Amount appropriated by the sundry civil act of March 4, 1909	$25,000.00
Amount expended during the fiscal year	19.32
July 1, 1909, balance unexpended	24,980.68
July 1, 1909, outstanding liabilities	11.34
July 1, 1909, balance available	24,969.34

(See Appendix A A 4.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated June 4, 1907, and April 30, 1908, on preliminary examination and survey, respectively, of *Missouri River from the mouth to Sioux City, Iowa,* required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1120, Sixtieth Congress, second session. The estimated cost of improvement with a probability of providing more than 6 feet, and not less than 10 feet, is $50,000 per mile, and it is believed that no plan of improvement of less scope than complete and continuous control of the river, at least as far as Kansas City, should be undertaken. This will require about ten years and appropriations at the rate of not less than $2,000,000 annually should be assured. The question of advisability of undertaking such a project is left, however, for determination by Congress.

IMPROVEMENT OF RIVERS AND HARBORS IN THE NASHVILLE, TENNESSEE, DISTRICT.

This district was in the charge of Maj. Wm. W. Harts, Corps of Engineers, having under his immediate orders to April 4, 1909, Capt. A. B. Putnam, Corps of Engineers. Division engineer, Col. Wm. T. Rossell, Corps of Engineers.

1. Obion and Forked Deer rivers, Tennessee.—The river and harbor act of June 13, 1902, authorized the joint improvement of the Obion and Forked Deer rivers.

(*a*) *Obion River.*—This stream is situated in northwestern Tennessee. It is formed by the junction of its North and South forks about 6 miles northeast of Obion, which is considered the head of navigation for steamers and other craft, and it flows in a general southwesterly direction about 75 miles, entering the Mississippi River some 5 miles below the Missouri and Arkansas state line. It is probable that rafting and logging are feasible as far up as 25 miles above Obion.

In its original condition the obstructions on this river were almost wholly drift, snags, and overhanging trees, which made navigation difficult and uncertain.

The original project was based on a survey made in 1891, and was adopted by the river and harbor act of July 13, 1892. The scope of the work was to obtain 3-foot navigation at low water by means of open-channel work, at an estimated cost of $50,000. After an expenditure of $15,795.01 this project was modified in June, 1897, to one for maintenance, so as to keep the river free from such obstructions as would prevent navigation at medium and high stages, at an estimated annual cost of $2,500.

In 1903 the annual expenditure recommended for maintenance of the Obion and Forked Deer rivers combined was reduced from $4,500 to $2,250. (See Annual Report for 1904, p. 2351.)

Appropriations and allotments aggregating $29,400 have been made for the Obion River, of which $28,395.62 have been expended under the present project to June 30, 1909.

No work was done during the past fiscal year. The funds expended were applied to maintenance of the floating plant.

The expenditures have resulted in temporary improvements to the channel, lessening the dangers to navigation at medium and higher stages from Obion, Tenn., to the mouth of the river. The navigability of the Obion River depends largely on the stage of water in the Mississippi. Navigation is not practicable at low stages.

For the calendar year ending December 31, 1908, the reported commerce on this stream amounted to 8,684 tons, having an estimated value of about $51,415, consisting almost wholly of timber products; passengers carried, 100.

For additional details of the Obion River, see the account of its survey in the Annual Report of 1891, page 2992. The effect of the improvement on freight rates is not believed to be important and can not readily be ascertained.

The district officer expresses the opinion, for reasons stated in his report, that further appropriations under this project are not warranted.

July 1, 1908, balance unexpended	$1,213.21
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	208.83
July 1, 1909, balance unexpended	1,004.38
July 1, 1909, outstanding liabilities	13.00
July 1, 1909, balance available	991.38

(*b*) *Forked Deer River.*—This stream is formed by the junction of its North and South forks about 8 miles southwest of Dyersburg, and flows thence in a general southwesterly direction about 21 miles, entering the Obion River about 3½ miles from the Mississippi. Dyersburg is considered the head of navigation on the North Fork. Jackson, Tenn., 95½ miles above the mouth, was formerly considered the head of navigation on the South Fork, but in recent years navigation appears to have been limited to the lower portion of this stream. It is probable that rafting and logging can be carried on to a distance of 25 miles above Dyersburg.

In their original condition the main stream and its branches, the North Fork and South Fork, were greatly obstructed by snags and drift. The original project may be said to have been adopted by the river and harbor act of August 2, 1882, and was based on a report of an examination of South Fork, dated December 16, 1880. This project was subsequently modified by extension to include the North Fork and main stream until appropriations aggregating $25,000 were made and expended. The operations proposed were open-channel work, by which it was sought to maintain a satisfactory channel all the year round. This project was set aside in view of the fact that the result aimed at could not be accomplished by this method.

The present project for maintenance, based on the provisions of the act of March 3, 1899, provided for the removal of surface obstructions from the Forked Deer River and its navigable branches (North and South forks), at an estimated annual cost of $2,000. In 1903 the annual expenditure recommended for maintenance of both the Obion and Forked Deer rivers was reduced from $4,500 to $2,250. (See Annual Report for 1904, p. 2351.) Under this project appropriations and allotments aggregating $12,600 have been made, of which $11,766.37 has been expended to June 30, 1909. The expenditures have resulted in temporary improvements to the channel, lessening the dangers to navigation at medium and higher stages. The navigability of the Forked Deer River depends largely upon the stage of water in the Mississippi. Navigation is not practicable at low stages.

No work was done during the past fiscal year. The funds expended were applied to the maintenance of the floating plant.

For the calendar year ending December 31, 1908, the reported commerce on this stream amounted to 16,165 tons having an estimated value of about $35,150, and consisting almost wholly of timber products. Passengers carried, 300.

For references to sundry examinations and surveys of the Obion and Forked Deer rivers, see the Report of the Chief of Engineers for 1908, page 553. For the report of the survey of the South Fork of the Forked Deer River dated January 22, 1908, see House Document No. 945, Sixtieth Congress, first session.

The effect of the improvement on freight rates is not believed to be important and can not readily be ascertained.

This river has been combined with the Obion in the work of improvement, and they have ordinarily been considered together in making appropriations of funds.

The district officer expresses the opinion, for reasons stated in his report on Obion River, that further appropriations under this project are not warranted.

July 1, 1908, balance unexpended	$985.17
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	151.54
July 1, 1909, balance unexpended	833.63
July 1, 1909, outstanding liabilities	11.50
July 1, 1909, balance available	822.13

CONSOLIDATED.

July 1, 1908, balance unexpended	$2,198.38
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	360.37
July 1, 1909, balance unexpended	1,838.01
July 1, 1909, outstanding liabilities	24.50
July 1, 1909, balance available	1,813.51

(See Appendix B B 1.)

2. *Cumberland River, Tennessee and Kentucky.*—The Cumberland River rises in eastern Kentucky, on the western slope of the Cumberland Mountains, flows in a tortuous course of about 688 miles through eastern Kentucky, middle Tennessee, and western Kentucky, and discharges into the Ohio River near Smithland, Ky. From Burnside, Ky., the head of steamboat navigation, to Smithland, Ky., the distance is 518 miles by the river, 203 miles being in the State of Kentucky and 315 miles in the State of Tennessee.

(*a*) *Below Nashville* (*193 miles*).—From 1830 to 1840 the legislatures of Tennessee and Kentucky made several appropriations for the improvement of the navigation of the Cumberland River, but little benefit to the general condition of the river seems to have been accomplished. The Cumberland Navigation Company was incorporated by the State of Tennessee in 1846 for improving the "navigation of the Cumberland River below the town of Nashville by means of a system of locks and dams," but nothing effective was done to carry out the proposed improvement.

In its original condition this section of the river was considerably obstructed by rocky ledges, conglomerate, gravel, and sand bars, snags, and other surface obstructions, on account of which navigation was rendered very uncertain.

From July 17, 1832, to July 7, 1838, Congress made five appropriations for improving the Cumberland River, Tennessee and Kentucky, aggregating $155,000, $20,000 of which was to be expended below Nashville and $135,000 on the river generally, but all the appropriations for the above period were expended below Nashville, to improve the worst localities.

Between 1838 and 1871 no appropriations for this river were made. The original project (open-channel work), which provided specifically for operations on this section, was adopted by the river and harbor act of March 3, 1871, based on project submitted January 20, 1871. The work proposed was as follows: To excavate the bars and rock ledges in order to get an additional depth of water; to contract the waterways in places in order to get the requisite depth; to remove snags and bowlders from the main channel; and to restrain tributary streams in well-determined channels at their junction with the river.

To increase the depth of water at the shoals in Kentucky Chute at the junction of the Cumberland with the Ohio River, a Board of Engineer officers in 1888 recommended the construction of a dike near Smithland, Ky., at an estimated cost of $129,600. The river and harbor act of September 19, 1890, allotted $30,000 from the appropriation for improving Cumberland River below Nashville, to be expended in improving the mouth of the river, as recommended.

Appropriations aggregating $305,000 were made and expended, thus completing the above project. The expenditures under the old project have resulted in lengthening the season of navigation by giving an increased depth at low water combined with greater security in the passage of obstructions.

The present project for improving the Cumberland River below Nashville was adopted July 13, 1892, by the river and harbor act of that date. It contemplates the extension of the lock and dam system of the upper river over a considerable portion of the river below Nashville by the construction of 7 locks and dams, commencing at or near Harpeth shoal (Lock A) and ending at Big Eddy shoal (Lock G); the locks to be 52 feet wide and 280 feet long, with lifts varying from 8½ to 11½ feet and aggregating some 70 feet. The project also includes the improvement of the Kentucky Chute, at the mouth of the river, as recommended by the Board of Engineer officers in 1888, the necessary channel work below Lock G, and the removal of surface obstructions, snags, logs, etc., below Nashville. The total estimated cost of the entire improvement is $1,964,500. (Annual Report of the Chief of Engineers for 1894, p. 1806.)

Under this project appropriations and allotments aggregating $450,000, which, with receipts from sales and other receipts, $986.30, makes a total of $450,986.30.

The total expenditures under this project to June 30, 1909, amount to $440,745.61, of which sum about $20,897.60 have been applied to maintenance.

These expenditures have resulted in the periodical removal of snags and other surface obstructions from the navigable channel, the protection of the bank of a part of Cumberland Island in Kentucky Chute at the mouth of the river, and the completion and placing in operation of Lock A, November 26, 1904, whereby 6-foot navigation has been afforded all year round for a distance of 38.8 miles above the lock. The season of profitable navigation from the Ohio River to Nashville has been prolonged by forty-five to ninety days, depending on the stage of water, making it now average eight months annually. Lock A is 41.4 miles below Nashville.

The Cumberland River below Nashville is usually navigable for all steamboats plying on it for six months in each year; for boats not drawing over 3 feet, from six to eight months, and for boats drawing 16 inches or less, the whole year. General navigation, however, is practically closed for several months each year during low water. As a general rule, when the stage is below 2½ feet, navigation is closed; between 2½ feet and 5 feet, it is uncertain, and above 5 feet, good. A table is given on page 390 of the Annual Report of the Chief of Engineers for 1902, showing the stages at Burnside, Carthage, Nashville, and Clarksville for the years 1898–1902.

No work of improvement was carried on during the past fiscal year.

The funds expended were applied to the cost of the survey for locks and dams authorized by the act of March 2, 1907.

For references to detailed reports and maps and to the report of the Board of Engineers for Rivers and Harbors concerning the further improvement of the Cumberland River see the Annual Report of the Chief of Engineers for 1908, page 555.

A preliminary report of the survey ordered by the act of March 2, 1907, is printed in House Document No. 758, Sixtieth Congress, first session. The final report is printed in House Document No. 1481, Sixtieth Congress, second session.

In these reports the district officer recommends the further improvement of the Cumberland River below Nashville by the construction of the necessary locks and dams. This recommendation was concurred in by the division engineer, Board of Engineers for Rivers and Harbors, and the Chief of Engineers.

Attention is invited to the recommendation of the district officer in the appendix to this report that the necessary funds for the commencement of the work be appropriated at the earliest date practicable. This recommendation is concurred in.

The reported commerce for the calendar year 1908 was 259,734 tons, having an estimated value of about $4,621,197; passengers carried, 33,000. The tonnage consisted principally of timber and farm products, and general merchandise.

It is reported that the Tennessee Central Railroad, which parallels the Cumberland River from Nashville to Clarksville, had rates in force before the completion of Lock and Dam A of from 18 to 26 cents per 100 pounds, and since this lock was put in operation these rates have been reduced above the lock to from 6 cents to 12 cents per 100 pounds.

The quantity of grain handled by the local steamboats has increased considerably since the completion of Lock A and a new line of steamboats, the Tyner Line, has been operating during the boating season.

It appears from reliable information that the cost of transporting grain by river to Nashville is about 8 cents per 100 pounds from points below Evansville on the Ohio River, while it is 15 cents per 100 pounds by way of river to Henderson or Uniontown, Ky., and thence by rail to Nashville, or a saving of about 7 cents per 100 pounds by all river transportation. Within the past year freight rates by rail have advanced 12½ to 20 per cent on every class of merchandise going south out of Nashville, while into Nashville it appears that the tariff has not been advanced. There is little doubt that the competition offered by the Cumberland River, even in its present condition, is the cause of the favorable rates into Nashville.

The amount estimated as a profitable expenditure in the fiscal year ending June 30, 1911, will be applied to necessary maintenance. The funds are needed for maintaining the river in a navigable condition. No estimate is submitted for further work on the old or existing project for improvement by locks and dams pending action by Congress on the new plan for slack water improvement referred to above.

July 1, 1908, balance unexpended	$8,731.44
Cash allowance received from Underwood Typewriter Company	12.25
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	18,743.69
June 30, 1909, amount expended during fiscal year, for survey	8,503.00
July 1, 1909, balance unexpended	10,240.69
July 1, 1909, outstanding liabilities	6.95
July 1, 1909, balance available	10,233.74

Amount (estimated) required for completion of existing project	$1,549,818.81
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*b*) *Above Nashville* (*357 miles*).—This section extends from Nashville to the mouth of Rockcastle River. In its original condition it was considerably obstructed by rock reefs, ledges, snags, etc., which greatly impeded navigation between Nashville and Burnside (about 325 miles), while above Burnside the Smith shoals formed a serious obstruction to navigation at practically all stages.

The original scheme of improvement above Nashville, as modified and extended, contemplated open-channel work from Nashville, Tenn., to Cumberland Ford (Pineville, Ky.), 497 miles, at an estimated cost of $374,764, and was based on projects submitted January 20, 1871, and February 8, 1872.

The first appropriation, specifically applicable to the Cumberland River above Nashville, was made by the act of August 14, 1876.

This open-channel scheme of improvement, or old project, resulted in giving increased depths at several of the principal obstructions, thus securing a longer and safer period of navigation. Under this project and its modifications appropriations aggregating $346,000 were made and expended.

The project for the canalization of the Cumberland River above Nashville, based on reports of an examination and survey in 1882 and 1883, was adopted by the river and harbor act of August 5, 1886.

This scheme of improvement provided for the construction of 22 locks and dams below Burnside, Ky., and 6 locks and dams at Smith shoals, above Burnside, the intention being to provide a complete system of lockage from Nashville, Tenn., to Rockcastle River, so as to afford a channel depth of 6 feet, the locks to be 52 feet wide and 280 feet long, with lifts varying from 10 to 12 feet, at an estimated cost of $8,500,000.

On February 16, 1905, the Board of Engineers for Rivers and Harbors reported on the project of canalization as follows:

> The Board is of the opinion that the regulation of the river and * * * the completion of Locks and Dams 3, 4, 5, 6, and 7 above Nashville, so as to carry the improvement of the river from its mouth to Carthage, Tenn., is worthy of being continued by the United States, but that the construction of the locks and dams proposed between Carthage and Burnside, except No. 21, now under contract, is not at present justified by the commerce involved.

The river and harbor act of March 2, 1907, adopted the modified project for completing the improvement in accordance with this report by providing for the completion of Locks and Dams Nos. 3, 4, 5, 6, and 7 at an additional expenditure of $550,000, thus reducing the cost of the project as modified to $2,769,000, increased in the report for 1908, page 1690, to $2,854,000. The act appropriated $150,000 and authorized continuing contracts in the further sum of $400,000 for completing the project. The entire amount so authorized has now been appropriated.

For the statement concerning the annulment of the contract for constructing Lock and Dam No. 21 see the Report of the Chief of Engineers for 1908, page 1689.

The district officer, in the appendix to this report, recommends that an additional sum of $85,000 be appropriated to finish the work at Lock 21, as experience shows that it will be impossible to build the dam and do the necessary work of bank protection and paving within the present estimate of cost. His recommendation is concurred in.

Attention is invited to the district officer's further recommendation in this connection, however, that no such appropriation be made for the completion of this work unless the town of Burnside, which is in the vicinity of the proposed lock and will derive the greatest benefit from the improvement, furnish adequate terminal facilities by reserving for all time, by appropriate legislative action, a portion of its water front, and devote it exclusively to the accommodation of river commerce upon such terms as will be reasonable and just to the public.

Under the project of canalization appropriations and allotments aggregating $2,779,000 have been made; $493.15 have been received from recoveries, sales, etc., making a total of $2,779,493.15. Of this amount about $42,036.95 is chargeable to maintenance, leaving $2,737,456.20 applicable to works of improvement. The total expenditures under this project to June 30, 1909, amount to $2,378,110.47, of which sum about $31,564.15 was applied to maintenance.

These expenditures have resulted in an improved channel way by the periodical removal of snags and other surface obstructions; the completion and operation of Lock and Dam No. 1 (2.5 miles below Nashville); Lock and Dam No. 2 (9 miles above Nashville); and Lock and Dam No. 3 (26 miles above Nashville); the completion of the masonry required for locks and abutments of dams Nos. 4, 5, 6, and 7 (44.7, 72, 89, and 106.6 miles, respectively) above Nashville; the purchase of sites for abutment at Lock No. 8 (125.2 miles above Nashville); and for Lock and Abutment No. 22 (320.2 miles above Nashville); the selection of sites for the locks of the Smith shoals system; the letting and partial execution of the contracts for the construction and erection of the gates for Locks 3 to 7, and for Lock 21; the partial construction of Lock No. 21; the purchase and delivery of the lumber for Dam No. 5; and contingencies pertaining to the entire improvement.

The Cumberland River is navigable usually from Nashville to Burnside, Ky., 325 miles, for steamboats drawing not more than 3 feet from four to six months of each year, and for boats of greater draft from two to three months. The fall is 223 feet, or about 8 inches per mile.

From Nashville to Caney Fork River (Carthage, 116 miles) the river is navigable for steamboats of 2½ feet draft from six to eight months, and for those of greater draft four or five months. Steamboats of light draft can ascend to Burkesville, 236 miles above Nashville, for from five to seven months and larger boats four or five months.

The head of navigation is Burnside, Ky., for steamers and other craft. This section is considered navigable for rafting and logging for about 35 miles above Burnside.

Lock No. 1 was placed in operation November 26, 1904. The completion of this lock affords a good harbor at Nashville, where a number of new boats and barges were put in commission as a result of this improvement.

Lock No. 2 was put in operation on October 9, 1907, and Lock No. 3 was placed in operation on October 15, 1908. The completion of these three locks gives a 6-foot navigation the year round for a distance of about 47 miles above Nashville.

The early completion of the work at Locks Nos. 4, 5, 6, and 7, where the more expensive masonry parts have already been built, is regarded of great importance, as this is necessary to make the improvement available and will provide a permanent channel for navigation from Nashville to Carthage and the Caney Fork River. When these locks are in operation the effect of the project on freight rates will be more fully apparent.

The expenditures during the past fiscal year were applied to the completion of placing Lock No. 3 in operation; erecting the lock gates under contract at Locks Nos. 4 and 5; partial construction of Dam No. 5; purchase and delivery of the materials preparatory to the construction of the guard walls at Locks Nos. 6 and 7; quarrying stone for dams; letting of the contract for the delivery of the timber for Dam No. 4; construction of two lock houses at Lock No. 3; construction of floating plant and temporary buildings for shops and quarters at Locks Nos. 6 and 7; construction of Lock No. 21 and contingencies pertaining to the entire improvement.

The amount expended for maintenance during the past fiscal year was applied to the purchase of material for a snag boat.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year 1911 as follows: Eighty-five thousand dollars to the work of placing Lock No. 21 in operation, and $10,000 to maintenance of improvement. The funds are needed to make the improvement available for the needs of commerce and for maintaining the channel of the river in a navigable condition.

The commerce on the Cumberland River above Nashville for the calendar year 1908, as nearly as could be ascertained, aggregated 246,260 tons, having an estimated value of about $8,745,289; passengers carried, 8,635. The tonnage consisted mainly of timber and farm products and general merchandise.

For references to surveys see page 495, Annual Report of Chief of Engineers, 1906.

July 1, 1908, balance unexpended		$399,049.59
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
Amount appropriated by sundry civil act approved March 4, 1909		250,000.00
Cash allowance received from Underwood Typewriter Co		17.25
		659,066.84
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$257,469.88	
For maintenance of improvement	214.28	
		257,684.16
July 1, 1909, balance unexpended		401,382.68
July 1, 1909, outstanding liabilities		25,153.34
July 1, 1909, balance available		376,229.34

July 1, 1909, amount covered by uncompleted contracts		$43,488.70
Amount (estimated) required for completion of existing project		85,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	[a] $85,000.00	
For maintenance of improvement	10,000.00	
		95,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix B B 2.)

3. Operating and care of locks and dams on Cumberland River.—Four locks are now in operation: Lock A, the first of the series below Nashville, and Locks 1, 2, and 3 of the series above Nashville.

They have an available length of 280 feet, a clear width of 52 feet between walls, and a depth of 6½ feet on miter sills at low water, except at lower miter sill of Lock A, where the present low-water depth is only 1 foot. This depth will be increased to 6½ feet by the construction of the next lock below.

The first allotment from the indefinite appropriation of July 5, 1884, for the operation and care of these locks was made June 26, 1905.

During the calendar year 1908 the traffic past Lock A was about 104,743.9 tons; past Lock No. 1 about 102,651 tons; past Lock No. 2 about 187,553.4 tons; past Lock No. 3 about 3,658.2 tons since it was placed in operation in October, 1908.

A special allotment of $9,000 was made for the purchase of a pump boat for pumping out the lock pits when they fill up with material. This vessel will be constructed at Muscle Shoals Canal, and is expected to be placed in commission early next fall.

The funds expended were applied to the repair of Dam A with concrete, and to the expenses of operating and care of lock gates, buildings, and grounds.

The amount expended to June 30, 1909, was $60,977.41, of which $31,801.58 were expended during the past fiscal year.

(See Appendix B B 3.)

4. Caney Fork River, Tennessee.—This stream lies in the central part of Tennessee. After a course of about 200 miles, wholly in the State, it empties into the Cumberland River at Carthage, Tenn., about 116 miles above Nashville. It is the largest tributary of the Cumberland River.

In its original condition the principal difficulties were found to be rock reefs, gravel and sand bars, and a crooked and shallow channel greatly impeded by surface obstructions.

No work was done by the United States prior to that begun under the present project. The present project, adopted June 14, 1880, is based on the report of 1879, and an extension of the project is based on the report of 1886. It provides for improving the 92 miles of river from Franks Ferry, the head of navigation, to its mouth, Carthage, Tenn., by removing the surface obstructions, building riprap dams and training walls, so as to obtain sufficient water for safe navigation during boating season for steamboats drawing not more than 3 feet, at an estimated cost of $45,228. (Annual Report of the Chief of Engineers for 1887, p. 1767.)

---

[a] An appropriation of this amount is recommended by the district officer and the Chief of Engineers, subject to certain important conditions set forth on page 589 of this report.

Rafting and logging does not appear to be practicable above Franks Ferry.

Under the project referred to, appropriations aggregating $28,000 have been made and $12.25 received from other sources, and $27,839.83 expended to the close of the fiscal year ending June 30, 1909.

From August, 1880, when the first work was done, to August, 1891, when the last work was done, $25,000 was expended. The results were an improvement of the channel at a 3-foot stage from Franks Ferry to the mouth of the river. The improvement, however, was not permanent and can not be made so under the present project. The additional work required is therefore practically for maintenance.

No appropriations were made from 1890 to 1905, and no work was done for upward of seventeen years.

The funds expended during the past fiscal year were applied to clearing the channel of the river of surface obstructions and care of plant.

In view of the meager benefits resulting, it is not believed that future appropriations are warranted under this project.

The effect of the improvement on freight rates is not believed to be important and can not be readily ascertained.

The commerce on the Caney Fork River for the calendar year 1908, as nearly as could be ascertained, aggregated 16,480 tons, having an estimated value of $79,013.

July 1, 1908, balance unexpended	$1,533.69
Cash allowance received from the Underwood Typewriter Company	12.25
	1,545.94
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,373.52
July 1, 1909, balance unexpended	172.42

(See Appendix B B 4.)

SURVEY OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Report dated January 18, 1909, on a survey of *Cumberland River, Tennessee and Kentucky, below Nashville*, with a view to the construction of locks and dams in that portion of the river heretofore surveyed in which no locks and dams have been constructed, required by the river and harbor act of March 2, 1907, was duly submitted by the district officer. It was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and was transmitted to Congress and printed in House Document No. 1481, Sixtieth Congress, second session. A plan of improvement is presented which has in view the construction of three more locks and dams, (D, E, and F) to complete the system of six in all, the estimated cost of which is $1,905,688.80.

IMPROVEMENT OF RIVERS AND HARBORS IN THE CHATTANOOGA, TENNESSEE, DISTRICT.

This district was in the charge of Maj. Wm. W. Harts, Corps of Engineers, having under his immediate orders to April 4, 1909, Capt. A. B. Putnam, Corps of Engineers. Division engineer, Col. Wm. T. Rossell, Corps of Engineers.

TENNESSEE RIVER SYSTEM.

The Tennessee River is 652 miles long. It is formed by the junction of the French Broad and Holston rivers, 4.5 miles above Knoxville and 188 miles above Chattanooga, and flows into the Ohio at Paducah, 464 miles below Chattanooga. Together with its principal tributaries it forms a system of internal waterways capable of being navigated more than 1,300 miles by steamboats. In addition to this, its tributaries are still further navigable by rafts and flatboats for a distance of more than 1,000 miles, thus making a system of navigable waters about 2,350 miles in length, with a drainage area of about 44,000 square miles.

The river is navigable the entire year from the mouth to Riverton, Ala. Just above Riverton a lateral canal about 8 miles long is now under construction past the Colbert and Bee Tree shoals, and the Muscle Shoals Canal now surmounts the Big Muscle and Elk River shoals.

Under the act of April 26, 1904, as amended by act of January 7, 1905, a lock and dam to be built mainly by private parties are projected at Hales bar, designed to form a pool extending 33 miles upstream to Chattanooga.

Local boat lines have headquarters at the principal towns along the river. There is no through traffic covering the entire length of the river, the longest regular boat service being found between Chattanooga and Paducah when the stage of water permits.

The amount so far appropriated and allotted for the Tennessee River and the canals thereon is $8,541,337.15; amount received from other sources, $2,461.95, making the total received $8,543,799.10. Of this the sum of $1,122,882.26 has been allotted for operating, care, and repair of the Muscle Shoals Canal from November, 1890, when it was opened to navigation, to June 30, 1909.

Freight rates are said to be already considerably lowered by this project, but there is no information available indicating to what extent they will be affected by its completion.

1. *Tennessee River.*—The improvement has been carried on in three sections under separate appropriations.

(*a*) *Above Chattanooga, Tenn.* (*188 miles*).—In its original condition this part of the river was obstructed by rock reefs, bowlders, gravel bars, and snags. The depth of water on the bars varied from 10 to 30 inches at low water, and in some places the current was as great as 6 miles an hour. The average slope is 0.956 foot per mile, with average low-water discharge varying from about 3,000 cubic feet per second at Knoxville to about 6,000 cubic feet per second at Chattanooga.

The present project, adopted by Congress in act of August 18, 1894, is to obtain by training walls, wing dams, and dredging a low-water channel 3 feet deep from Chattanooga to the mouth of the French Broad River, at an estimated cost of $650,000. Up to June 30, 1895, the sum of $328,255.83 had been expended under a previous project, and there remained 55 obstructions having less than 3 deet depth at low water. A revision of the estimate in 1907, on a basis of present unit prices, places the cost of the existing project at $1,709,000.

Appropriations and allotments under the present project amount to $352,014.63, and the receipts from sales, etc., have been $155.70; making a total of $352,170.33. The total amount expended under the present project to June 30, 1909, is $307,841.29, including $13,915.16 for maintenance.

Operations in recent years have been mainly concentrated at the formidable series of obstructions extending from Caney Creek shoals (about 98 miles above Chattanooga) downstream for a distance of about 8 miles. The projected works in that vicinity are well advanced toward completion, and a marked increase in channel depths has been obtained.

The work done in the past fiscal year comprised dredging and dike construction at Caney Creek shoals and dike construction at Little River shoals (12 miles below Knoxville). Operations were suspended in October, owing to the exhaustion of funds. In January, 1909, under an allotment made for the purpose, some work was undertaken at the latter place with a view to the reduction of objectionable current velocities due to the incomplete stage of the improvement. The funds expended for maintenance during the fiscal year were applied to this emergency work at Little River shoals and to the construction and repair of floating plant needed in the work of preserving the navigable condition of the channel.

The new wooden-hull steam tender *Chilhowee*, built under contract at a cost of $10,000, was launched in August, 1908.

The maximum draft that can be carried at mean low water over the shoalest place in this section is about 18 inches. The extreme flood oscillations range from about 40.5 feet at Knoxville to about 58 feet at Chattanooga.

The commerce reported on this portion of the river during the calendar year 1908 amounted to about 621,500 tons, valued at about $3,187,620; the principal items in order of value being marble, general merchandise, logs, and grain.

A map of this section of the river is printed in the Annual Report of the Chief of Engineers for 1876, page 710, and an account of its survey in the report of 1893, page 2333.

It is proposed to apply the amount given as a profitable expenditure in the fiscal year 1911 to maintaining the navigable waterway by the removal of minor channel obstructions and the repair of existing works of regulation, and to continuing improvement under the existing project for the purpose of extending the benefits already secured.

No active operations were carried on in the Little Tennessee River during the fiscal year. The total expenditures for its improvement up to June 30, 1909, amount to $5,510.09. Owing to the slight use made of this tributary, it is believed that further allotments from appropriations for the upper Tennessee River should not be made for it for several years, and no sum is therefore given as a profitable expenditure in the fiscal year 1911.

TENNESSEE RIVER ABOVE CHATTANOOGA.

July 1, 1908, balance unexpended		$35,049.41
Received from sales		2.85
Amount allotted from appropriation by river and harbor act approved March 3, 1909		50,000.00
Allotment from emergency act of March 2, 1907		1,270.46
		86,322.72
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$35,049.41	
For maintenance of improvement	6,944.27	
		41,993.68
July 1, 1909, balance unexpended		44,329.04
July 1, 1909, outstanding liabilities		2,461.29
July 1, 1909, balance available		41,867.75
Amount (estimated) required for completion of existing project		1,080,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		160,000.00

LITTLE TENNESSEE RIVER.

July 1, 1908, balance unexpended	$1,489.91
July 1, 1909, balance unexpended	1,489.91

(*b*) *Chattanooga, Tenn., to Riverton, Ala.* (*238 miles*).—In its original condition the channel from Chattanooga to Browns Ferry was obstructed by bars, bowlders, reefs, and rocky projections. Navigation was possible during six to nine months annually. Between Browns Ferry and Florence were the Muscle shoals obstructions, which could be crossed only at unusually high water. Between Florence and Riverton the Colbert and Bee Tree shoals prevented navigation for six months in the year.

The average slope is 1.5 feet per mile from Chattanooga to Scott Point (17.5 miles), thence 0.4 foot per mile to head of Muscle Shoals Canal (158 miles), thence 2.73 feet per mile to Riverton (62.5 miles), with average low-water discharge varying from about 6,000 cubic feet per second at Chattanooga to about 10,000 cubic feet per second at Riverton.

Under a former project the Muscle shoals section was improved, at a cost of $3,191,726.50, by some channel work at Little Muscle shoals and by the construction of a lateral canal in two divisions, one on the left bank about 3.5 miles long, with 2 locks, around the Elk River shoals, and the other on the right bank, about 14.5 miles long, with 9 locks, around the Big Muscle shoals. This work was done mainly from 1875 to 1890, under a project adopted originally in 1868.

Expenditures aggregating $595,532.74 have been made in the improvement of the open river at various localities between Chattanooga and Riverton under a former project, dating back to 1868, which contemplated securing a least depth of 3 feet at low water in the improved channels.

The existing projects for the improvement of this section are three in number. The first authorizes the construction by private parties of a lock and dam at Hales bar, about 33 miles below Chattanooga, which will form a pool extending above Chattanooga with a depth of at least 6 feet at low water, the parties doing the work being granted the use of the water power produced by the dam for a period of ninety-nine years. The United States is to prepare the plans, supervise the construction, and provide the gates, valves, operating machinery, and other appurtenances of the lock, at a total cost now estimated at $214,720. The project was adopted by act of April 26, 1904, amended (as to location of the work) by act of January 7, 1905.

The second project, adopted by act of March 2, 1907, provides for open-channel work to secure a depth of 5 feet at low water (in accordance with project submitted in H. Doc. No. 50, 57th Cong., 1st sess.) from Scott Point to Lock A, covering the stretch of 145 miles between Hales bar and the Muscle Shoals Canal, the revised estimate placing the cost of the work at $1,231,000.

The third project provides for the improvement of Colbert and Bee Tree shoals, near the downstream limit of this section, by the construction of a lateral canal about 8 miles long, with one lock of about 26 feet lift, at an estimated cost of $2,847,009.70. The original project was approved by the Secretary of War on November 28, 1890, and its last modification on June 12, 1905.

The appropriations and allotments under the present projects for the improvement of this section aggregate $2,547,644.24, and in addition the sum of $550.97 has been received from other sources, making a total of $2,548,195.21, of which the sum of $2,213,759.36 has been expended to June 30, 1909.

These expenditures have resulted in the preparation of plans for the Hales Bar lock and dam, the purchase of the metal work to be incorporated in the lock masonry, the letting of the contracts for the construction and erection of the upper and lower lock gates, the construction of a quarter boat for the United States inspecting force, and the supervision of the entire work, at a total cost of $47,283.80; in the partial improvement of the open-river channel at various points between Chattanooga and Riverton, notably at Allens bar, and the construction of floating plant needed to carry on advantageously the work of open-river regulation, at a cost of $108,404.96, including $3,048.70 for maintenance; and in the partial construction of the Colbert Shoals Canal, including the completion of the masonry of the lock, the construction of the concrete river wall, the excavation of about 90 per cent of the canal prism, the letting of a contract for the upper and lower lock gates, the erection of the lock houses, and the carrying out of minor incidental work by hired labor, at a total cost of $2,058,070.60.

The Muscle Shoals Canal provides a permanent depth of 5 feet, except in its approaches, where additional work will be required to secure this depth at low water, the improvement never having been fully completed at these points.

The maximum draft that can be carried at mean low water over the shoalest place between Chattanooga and Riverton is about 2 feet. The extreme flood oscillations range from about 69 feet at the Suck, 12 miles below Chattanooga, to about 10 feet at Lock No. 4 of the Muscle Shoals Canal.

The improvements at Hales bar and Colbert shoals will not be available for navigation until the works are completed.

At Hales bar the expenditures during the past fiscal year were applied to the letting of a contract for the lower gates, to the construction of a quarter boat for the United States inspectors, and to the cost of supervising the contract work of building the lock and dam. The concrete work is about 20 per cent completed, and about 35 per cent of the rock excavation and 68 per cent of the earth excavation had been accomplished up to the close of the fiscal year. In the annual report for 1908 (p. 564) the additional sum of $101,750 was estimated to be required for the completion of the work with which the United States is chargeable in connection with this improvement. The river and harbor act of March 3, 1909, carried an authorization of one-half of this amount, but no part thereof has yet been appropriated.

The funds expended during the fiscal year for open-channel work between Chattanooga and Riverton were applied to dredging at Allens bar, a serious obstruction between Hobbs Island and Guntersville, to dike construction at Chunn bar, and to the construction and repair of floating plant. Proposals were solicited for furnishing the machinery and fittings for a dipper dredge to be employed in this section of the river. Four bids were received, and the contract was awarded in the sum of $19,850.

In the appendix to this report the district officer gives his reasons for recommending an increased appropriation for open-channel work. His recommendation is concurred in.

The principal work done at Colbert shoals in the past fiscal year comprised excavation in the lower portion of the canal prism (three-fourths of the work that remained to be done having been accomplished), the construction of the final portion of the concrete river wall, and the erection of the necessary lock buildings. In addition to these contract operations, hired-labor work was continued during the year, the expenditures therefor having been applied to the paving of four waste weirs, the placing of the remaining portion of the toe wall for an embankment 1,650 feet long on the river side of the canal, the completion of the additional masonry required to bring the lock walls to the requisite height under the modified project, the construction of a road from Riverton to the lock and along the south bank of the canal, sodding portions of the canal slopes, and other minor operations. A contract was entered into for furnishing and erecting the upper and lower lock gates.

The district officer recommends in his report an additional allotment of $150,000 for completing the Colbert Shoals Canal. His recommendation is concurred in.

The sum given as a profitable expenditure in the fiscal year 1911 at Hales bar will be applied to the procurement by contract of the electrical machinery and equipment for operating the gates and valves, to providing lock houses, office, roads, walks, etc., to grading grounds, etc., and to the expenses of supervision and inspection.

It is proposed to apply the amount recommended for open-channel work, $360,000, to dredging and dike construction at shoal places between Chattanooga and Riverton, to providing a suitable working plant for this section of the river, and to maintenance of the existing channel, the object of the proposed work being to extend the benefits already secured from open-river improvement, and in addition to render available the important advantages to be derived from the opening of Colbert Shoals Canal to navigation.

The sum estimated as a profitable expenditure for the fiscal year 1911 at Colbert and Bee Tree shoals, $150,000, is to be applied to riprapping the banks of the canal where necessary, to purchasing and installing under contract the guard gates, filling valves, and operating mechanism of the lock, and to contingent expenses.

The commerce carried on the river between Chattanooga and Florence in the calendar year 1908 amounted to about 202,450 tons, the estimated value of which is given as $8,115,735. The most important items were general merchandise, cotton, and timber products.

For references to details of the river from Chattanooga to Riverton, see Annual Report of the Chief of Engineers for 1905, page 456.

HALES BAR LOCK AND DAM.

July 1, 1908, balance unexpended	$85,539.75
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	100,539.75
June 30, 1909, amount expended during fiscal year, for works of improvement	19,835.26
July 1, 1909, balance unexpended	80,704.49
July 1, 1909, outstanding liabilities	186.38
July 1, 1909, balance available	80,518.11
July 1, 1909, amount covered by uncompleted contracts	51,828.00
Amount (estimated) required for completion of existing project	101,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 101,750.00

OPEN-CHANNEL WORK.

July 1, 1908, balance unexpended	$176,270.78
Received from sales	18.78
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	181,289.56
June 30, 1909, amount expended during fiscal year, for works of improvement	77,977.10
July 1, 1909, balance unexpended	103,312.46
July 1, 1909, outstanding liabilities	13,992.75
July 1, 1909, balance available	89,319.71
Amount (estimated) required for completion of existing project	1,031,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	360,000.00

---

[a] Of this amount $50,875 is for continuing contract work authorized by the river and harbor act of March 3, 1909.

COLBERT AND BEE TREE SHOALS.

July 1, 1908, balance unexpended	$376,160.74
Received from sales	472.80
Amount appropriated by sundry civil act approved March 4, 1909	120,000.00
	496,633.54
June 30, 1909, amount expended during fiscal year, for works of improvement	346,214.64
July 1, 1909, balance unexpended	150,418.90
July 1, 1909, outstanding liabilities	38,161.65
July 1, 1909, balance available	112,257.25
July 1, 1909, amount covered by uncompleted contracts	88,385.08
Amount (estimated) required for completion of existing project	639,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(c) *Below Riverton, Ala. (226 miles).*—This section of the river lies below most of the large tributaries, and the slope being uniform and moderate and the width nowhere excessive it affords unusual facilities for navigation. The ruling low-water depths were originally about 3.5 feet over the lower 196 miles and 2 feet in the remaining portion. The average slope is 0.34 foot per mile, and the low-water discharge is about 10,000 cubic feet per second. In 1896 there were 49 localities having less than 5 feet depth at low water, and several other shoals have since developed.

The existing project, originally adopted September 19, 1890, and subsequently extended in its scope by the acts of August 18, 1894, and March 3, 1899, is to obtain, by dredging, a channel not less than 5 feet deep and 150 feet wide, and to protect Livingston Point and Tennessee Island from erosion with a view to preserving the port of Paducah, Ky.

The appropriations and allotments for this section amount to $397,197.74, and sums aggregating $838.49 have been received from other sources, making a total of $398,036.23.

The total amount expended to June 30, 1909, was $376,325.93, including about $57,197.05 for maintenance.

This expenditure has resulted in the completion of the work at Livingston Point and Tennessee Island at a cost of $77,367.65; in the removal of snags and the dredging of about 1,127,660 cubic yards of gravel at about 31 localities, thus removing the worst obstructions below Hamburg; and in the maintenance of the working plant employed in this section. The results of the dredging operations appear to be fairly permanent at about two-thirds of the places improved. The work done in the season of 1907 has been of unusual value.

The smallness of the balance available during the working season of 1908 and the high stages of the river that prevailed after funds became available from the enactment of March 3, 1909, rendered it impracticable to carry on any field operations during the fiscal year. The expenditures for the year (including the amount applied to maintenance) were incident to the construction and repair of floating plant and the purchase of supplies, preparatory to commencing the season's work.

The maximum draft that can be carried over the shoalest place in this section at mean low water is about 3 feet. The extreme flood oscillations range from about 48 feet at Johnsonville to about 55 feet at Paducah.

The commerce carried on the river between Florence and Paducah during the calendar year 1908 amounted to about 552,560 tons, the estimated value of which is given as $10,636,445; the principal items in order of value being general merchandise, railroad ties, peanuts, and cotton. Railroad ties formed the most considerable item in point of tonnage.

In the appendix to this report the district officer gives his reasons for recommending an increased appropriation for this section, and his recommendation is concurred in. It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year 1911 to maintenance of the existing waterway and to channel improvement at the shoal places offering the greatest obstruction to navigation. The work proposed will result in an extension of the benefits already secured, and will, moreover, serve an important purpose in rendering more fully available the improvement to be effected by the canal at Colbert and Bee Tree shoals, now nearing completion.

July 1, 1908, balance unexpended		$4,373.53
Received from sales		512.70
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,000.00
		29,886.23
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$4,873.53	
For maintenance of improvement	3,302.40	
		8,175.93
July 1909, balance unexpended		21,710.30
July 1, 1909, outstanding liabilities		3,432.76
July 1, 1909, balance available		18,277.54
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix C C 1.)

2. Operating and care of Muscle Shoals Canal, Tennessee River.—For details of this canal and of its operation and care, also dimensions of locks, aqueduct, and drift sluice, see pages 2440–2446, Annual Report of the Chief of Engineers for 1901, with corrections given on page 1729 of report for 1902.

The canal was opened to navigation in 1890. It is in two sections, aggregating about 18 miles in length, and has 11 locks. A railroad nearly 15 miles in length is operated in connection with the maintenance of the canal.

Fifteen streams empty into the canal, none of them very large. Bars are constantly forming opposite their mouths and also at the entrances to the canal. A bucket dredge is kept on the canal in order to remove these bars as fast as they form.

The freight transported through the canal in the calendar year 1908 amounted to about 12,537 tons, the estimated value of which was $1,097,140. The number of lockages made, exclusive of those of government craft, was 1,227.

The amount expended to June 30, 1909, was $1,119,803.80, of which the sum of $53,443.56 was expended during the year.

(See Appendix C C 2.)

3. French Broad and Little Pigeon rivers, Tennessee.—The French Broad River is one of the largest tributaries of the Tennessee. It rises in North Carolina, flows in a generally northwesterly direction, and finally unites with the Holston River in the State of Tennessee, about 4.5 miles above Knoxville, to form the Tennessee River. It has a drainage area of about 5,600 square miles. Leadvale, Tenn., about 70 miles above the mouth, has generally been considered the head of navigation in Tennessee, and it is not believed that rafting or logging is practicable to any great extent above this point. An isolated portion of the river in North Carolina, between Brevard and Asheville, was under improvement for several years from 1877 to 1882, and $43,000 was expended in removing obstructing bowlders, fish traps, and snags, and in dredging and constructing wing dams at Cherokee, Big Buck, and other shoals.

In its original condition the river was obstructed by rock reefs, sand and gravel bars, and by bowlders, snags, and overhanging trees, and numerous islands in the river divided the water and diminished the depth in the navigable channels. There were 41 shoals obstructing navigation below Leadvale. The average slope below Leadvale is about 2.3 feet per mile, and the low-water discharge at Leadvale is reported as about 2,000 cubic feet per second.

The Little Pigeon River is formed by the junction of its east and south forks at Sevierville, Tenn., and flows in a northerly direction for about 5 miles, emptying into the French Broad about 29 miles above its mouth. The Little Pigeon is navigable at ordinary stages only about 2 miles above its mouth (to Catlettsburg), and thus practically amounts to an additional landing on the French Broad. In its original condition this portion of the river was obstructed by a bar at its mouth.

The present project, adopted June 14, 1880, provides for open-river work on the French Broad to secure a navigable channel at low water from the mouth to Leadvale sufficient to permit the passage of boats drawing about 2.5 feet, at an estimated cost of $150,000, and for the removal of the bar at the mouth of the Little Pigeon.

To June 30, 1909, $147,000 had been appropriated and allotted for this improvement in both North Carolina and Tennessee, and $503.01 had been received from other sources, making an aggregate of $147,503.01.

The amount expended to June 30, 1909, for work in the State of Tennessee was $98,637.91, of which $8,085.16 was for maintenance. This expenditure has been applied to the improvement of 15 shoal places in the French Broad, the maintenance of the navigable channel, and the removal of the bar at the mouth of the Little Pigeon.

No active operations were carried on during the fiscal year, owing to insufficient funds. The expenditures were in connection with preparing and equipping the plant required for the coming season's work of maintenance.

The maximum draft that can be carried over the shoalest place at mean low water is probably about 18 inches. The extreme flood oscillation is about 30 feet, ordinary floods having a range of about 10 to 15 feet. Steamboats rarely go above Dandridge, 46.5 miles above the mouth, and all the improvements are below this place.

The commerce carried on this river during the calendar year 1908 amounted to about 26,930 tons, valued at about $397,360.

For details of the French Broad see the report of survey in the Annual Report of the Chief of Engineers for 1900, page 3018. An examination of the Little Pigeon is reported in the Annual Report for 1891, page 2287.

The direction of traffic on these streams is not parallel to rail lines. The effect of the improvement on railroad rates, therefore, would be indeterminate, though doubtless important.

The district officer recommends, in view of the commercial importance of the French Broad River, that a biennial appropriation of $10,000 be made for maintenance of the improvement. His recommendation is concurred in. It is also recommended that an appropriation of $18,000 for works of improvement be made for the fiscal year 1911, the work proposed being for the extension of benefits already obtained under the existing project.

July 1, 1908, balance unexpended	$3,177.52
Received from sales	1.05
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	8,178.57
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,313.47
July 1, 1909, balance unexpended	5,865.10
July 1, 1909, outstanding liabilities	175.68
July 1, 1909, balance available	5,689.42
Amount (estimated) required for completion of existing project	61,515.64
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	28,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix C C 3.)

4. *Clinch, Hiwassee, and Holston rivers, Tennessee.*—(*a*) *Clinch River.*—This river rises in the Cumberland Mountains in Virginia, and, after following a southwesterly course, empties into the Tennessee River at Kingston, 104 miles above Chattanooga. It drains an area of about 5,000 square miles. Its average slope below Clinton (60 miles from the mouth) is about 1.3 feet per mile. The ordinary low-water discharge at Clinton is about 900 cubic feet per second. There are about 193 miles of the river in the State of Tennessee.

In its original condition the channel was obstructed by rock reefs, sand and gravel bars, bowlders, snags, and overhanging trees.

The present project, adopted in 1880, provides for channel excavation, removing surface obstructions, and the construction of wing dams and training walls, so as to secure a navigable channel 2 feet in depth at ordinary low water from the mouth of the river to Clinton, about 60 miles, and of 1.5 feet in depth from Clinton to Haynes (or Walkers) Ferry, about 66 miles. From Haynes Ferry to the State line, a distance of about 67 miles, it is proposed simply to remove the loose rock and bowlders, reduce the rock ledges, and remove snags, overhanging trees, and similar obstructions, so as to assist raft and flatboat navigation at the stages at which the river is ordinarily used.

The sums thus far appropriated and allotted for this stream amount to $54,825.43, and $1.10 additional has been received from sales, making the total receipts $54,826.53.

The amount expended to June 30, 1909, was $54,401.12. This has been applied to reducing reefs, removing surface obstructions, and building wing dams and training walls, whereby the use of the river has been rendered practicable at stages 2 to 3 feet lower than before the improvement was begun. The expenditures of the past fiscal year were in connection with a public hearing and the inspection of certain bridges.

The town of Clinton has been reached by small steamboats, and is regarded as the practicable limit of steamboat navigation. Rafts are transported from points at least as far upstream as Speers Ferry, Va., 201 miles from the mouth.

The commerce reported on the Clinch River for the calender year 1908 consisted of 64,410 tons of logs rafted, valued at about $386,460, and about 900 tons of farm products carried between Harriman, on the Emory River, and Tennessee River points, a distance of 4.5 miles on the Clinch. Statistics of the traffic arriving at and departing from Kingston, Tenn., were not compiled separately from the commerce of the Tennessee River, as this town is situated so near the mouth of the Clinch as to make it virtually a Tennessee River port.

For reasons given in his report the district officer recommends the suspension of appropriations for this stream for the present.

For survey of this river see Annual Report of the Chief of Engineers for 1901, page 2542.

There is no information available indicating the extent to which freight rates are affected by this improvement. It seems safe to say that it will necessarily be slight until the time arrives when changed conditions shall have warranted the adoption of a plan for the radical improvement of this stream.

July 1, 1908, balance unexpended	$527.62
June 30, 1909, amount expended during fiscal year, for works of improvement	102.21
July 1, 1909, balance unexpended	425.41
July 1, 1909, outstanding liabilities	28.84
July 1, 1909, balance available	396.57

(*b*) *Hiwassee River.*—The Hiwassee River rises in the mountains of western North Carolina and northern Georgia, flows in a northwesterly direction, and enters the Tennessee River about 35 miles above Chattanooga. Its largest tributary is the Ocoee River, which enters it from the south about 35 miles from its mouth. The Hiwassee drains an area of about 2,725 square miles. Its average slope below the Ocoee is about 0.93 foot per mile. The low-water discharge at the mouth of the Ocoee is given as about 950 cubic feet per second.

On examination, made in 1874, the channel was found to be obstructed by rock reefs, gravel bars, shags, and overhanging trees.

The original project of improvement, based on the examination of 1874, was for a navigable channel 40 feet wide and 2 feet deep at ordinary low water to Savannah Ford, about 41.6 miles from the mouth of the river, to be secured by excavation of rock reefs and gravel bars and construction of wing dams. Expenditures under this project amounted to $36,427.07.

The present project, based on a survey made in 1899, contemplates the development of a channel of not less than 116 feet width and 30 inches mean depth between the mouth of the river and the mouth of the Ocoee River by use of spur dikes, training walls and submerged sills, bank protection, and dredging, at an estimated cost of $71,125. There were sixteen shoals having less than the desired depth at low water.

This project was adopted by the river and harbor act of June 13, 1902.

Under the present project $74,855.33 has been received from appropriations and allotments and $8.23 from sales, making a total of $74,863.56.

The amount expended on the present project to June 30, 1909, was $67,044.18. This has been applied to maintenance of the navigable channel and to work of improvement at Blackbird, Ackerman, Hogwallow, Rogers, Mathews, Agency, and Bunker Hill shoals, the most serious obstructions between Charleston and the mouth. In the past fiscal year channel work was carried on at each of these localities, mainly by dike construction and dredging. A new steamboat for this work, built under contract at a cost of $10,000, was launched in August, 1908.

The maximum draft that can be carried over the shoalest place at mean low water is about 2 feet. The extreme flood oscillation at Charleston, 19 miles above the mouth, is about 32 feet, but ordinary floods do not exceed about 15 to 18 feet. Small boats of about 100 tons capacity can navigate the river eight months in the year. Savannah Ford, 7 miles above the mouth of the Ocoee River, has at times been reached by steamboats, and is usually regarded as the head of navigation; although at present steamboat traffic does not extend above Charleston. Rafting and logging are not considered practicable above Savannah Ford.

The commerce on the Hiwassee River reported for the calendar year 1908 amounted to about 6,330 tons, valued at about $176,160. It consisted principally of farm products and general merchandise.

For report o survey see Annual Report of the Chief of Engineers for 1901, page 2458.

There is no information available indicating the extent to which freight rates will be affected by this improvement. It will probably be slight.

All the funds called for in the estimate of the present project have been appropriated. In order to maintain the improvement in an effective manner $10,000 should be appropriated biennially for maintenance, and this amount has been estimated for as a profitable expenditure in the fiscal year 1911.

July 1, 1908, balance unexpended	$39,263.95
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	44,263.95
June 30, 1909, amount expended during fiscal year, for works of improvement	36,444.57
July 1, 1909, balance unexpended	7,819.38
July 1, 1909, outstanding liabilities	2,022.51
July 1, 1909, balance available	5,796.87
Amount that can be profitably expended in fiscal year, ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*c*) *Holston River.*—The Holston River is formed by the junction of its north and south forks at Kingsport, Tenn., and flows thence about 142 miles in a southwesterly direction and unites with the French Broad 4.5 miles above Knoxville to form the Tennessee River. It drains an area of about 3,811 square miles. It has an average slope of about 2.5 feet per mile and a minimum discharge of about 650 cubic feet per second.

In its original condition the channel was obstructed by rock reefs and ledges, bowlders, snags, and overhanging trees. The present project, adopted in 1902, provides for the removal of channel obstructions and cutting overhanging trees from the mouth to Kingsport, at an estimated cost of $5,000.

Up to June 30, 1909, $6,017.17 has been allotted for this stream under the existing project, and $5,699.76 expended. The expenditures have resulted in clearing the channel of some of the most troublesome obstructions between the mouth and Ridleys shoals, a a distance of about 137 miles.

No operations were carried on during the fiscal year, the amount expended having been applied to the payment of telegrams.

There is no regular upstream navigation of the river. Occasionally a small steamboat runs up 30 to 60 miles from the mouth at times of high water.

The commerce reported for the calendar year 1908 consisted of about 12,210 tons of logs rafted, the value of which was estimated at about $61,050.

For report of survey, see Annual Report of the Chief of Engineers for 1901, page 2518.

Railroad rates are not believed to be at all affected by work carried on under the present project, which is practically for maintenance only.

For reasons given in his report the district officer states that further improvement of this stream is not warranted at the present time.

July 1, 1908, balance unexpended	$318.05
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	.64
July 1, 1909, balance unexpended	317.41

CONSOLIDATED.

July 1, 1908, balance unexpended		$40,109.62
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		45,109.62
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$36,444.57	
For maintenance of improvement	102.85	
		36,547.42
July 1, 1909, balance unexpended		8,562.20
July 1, 1909, outstanding liabilities		2,051.35
July 1, 1909, balance available		6,510.85
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		[a] 10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix C C 4.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST CINCINNATI, OHIO, DISTRICT.

This district was in the charge of Col. Wm. T. Rossell, Corps of Engineers, division engineer, central division.

1. *Ohio River (general open-channel improvement).*—This work was commenced by the General Government in 1827, when low-water navigation over many of the bars and shoals was impossible for commercial purposes; but the improvements made and maintained since then have provided fairly convenient channels at such places for a profitable light-draft local freight and passenger service during low-water periods. The difference in level of water surface of the river varies; at Cincinnati, nearly midway between the head and mouth of the river, the average annual range during the past thirty years is 48.4 feet.

The project under which operations have been carried on has been a continuous and progressive one, the principal features of the work being the removal of snags, rocks, and wrecks from the general channel; the direct improvement of bars and shoals, by dredging and rock excavation; the construction, repair, and maintenance of low dikes and dams to concentrate and direct the flow of water in improved channels; bank protection and the construction and repair of levees where required in the interest of navigation; the construction, repair, and maintenance of ice piers and harbors; miscellaneous improvement, including surveys, establishment, care, and record of water gauges, establishment of harbor lines, regulation of encroachment and deposits on the banks of the river or in its channel, and the supervision of construction of bridges across the river. The length of river through which the work extends is but little short of 1,000 miles, and the total expenditure in this district by the Government during the eighty-two years it has been in progress, exclusive of liabilities outstanding June 30, 1909, is $7,168,726.37.

---

[a] For Hiwassee River.

The principal operations of the year were as follows: The U. S. dredges *Ohio* and *Oswego* excavated 215,953 cubic yards of gravel, sand, etc.; 62.8 tons of rock, and 107.85 tons of snags; and the hired dredging plants excavated 80,626 cubic yards of gravel, sand, etc.; 3.75 tons of snags, and 1,100 feet b. m. wreckage. This dredging has resulted in improvement of the channel, making a depth of 5 to 6 feet below low water at Wills Creek, Jonathan Run, Wheeling Creek, Jenny Lind, Connoconneque, and Falling Run bars, Big Blue River Islands, Big Blue River, Fivemile, Fourmile, Peckenpaugh and Fulton bars, Troy reach, The Cabbage Patch, Rockport, Ind., Puppy Creek dike, Yellow Bank Towhead, Head of French Islands, French Islands, Vannada reef, Indian Hill, Flint Island, Evansville Harbor, Henderson dike, Caseyville, Ky., Tradewater and Walkers bars, and Sisters Island.

The installation of boilers, machinery, etc., on the combined hydraulic and grapple dredge *Indiana*, under contract of June 22, 1908, was completed with the exception of the thirty-day trial test, which was prevented by high stage of river. An electric-light plant, the plumbing, etc., and an ice plant were installed, and the necessary outfit, ponton pipe line, etc., purchased.

A contract was entered into on October 6, 1908, for construction of concrete dam at Browns Island; no work was done, but plant is at site ready to begin operation as soon as stage of water permits.

On the concrete dam at head of Marietta Island, under contract dated October 14, 1907, the following work was done and material placed: 9,208.8 cubic yards excavation, 80 cubic yards earth filling, 177 piles, 13,329 pounds of iron tie rods, etc.; 3,626.46 cubic yards large and 2,827 cubic yards small stone; 2,763.08 cubic yards concrete, and 30½ barrels extra cement.

Repair and bank protection to dikes opposite Evansville, Ind., under contract dated September 22, 1908, was carried on and completed, consisting of the following: 3,310 cubic yards grading, 190 cubic yards riprap stone removed and replaced, 1,413.97 cubic yards new riprap stone placed.

Work of constructing loose stone dike at head of Grand Chain, Ill., under contract of October 14, 1907, was carried on when stage of river permitted, as follows: 3,175 cubic yards of small stone carefully placed and 6,034 cubic yards of small stone roughly placed.

Work on dikes at Mound City, Ill., under contract of June 14, 1905, was carried on and completed. The total work done under this contract is as follows: Small stone, 12,589.042 cubic yards; large stone, 628 cubic yards; excavation, 585 cubic yards.

The work on Great Miami embankment, under contract of December 19, 1907, was carried on and completed. The total work done under this contract is as follows: Earth fill, 20,362 cubic yards; concrete, 19,597⅔ square yards.

Supervision was had of established harbor lines at Steubenville, Ohio, Wheeling, W. Va., Ironton, Ohio, and Cincinnati, Ohio. Maps of tentative harbor lines at East Liverpool were prepared and approved and a public hearing ordered; and maps of the Cincinnati harbor lines, showing the location of marking posts and witnesses to the same, were prepared.

Twenty-five permits were issued to cover the construction of gas, water, and oil pipe lines; overhead cables; tramway; intakes; trestle; bank protection; derrick, and pavilion.

Supervision was had of permits for all miscellaneous and bridge constructions below the Pennsylvania state line.

The nature of the Ohio River is such that its improvement, whether by canalization (locks and dams) or open channel, can not bring full benefit to navigation interests until the improvement shall have become more continuous than past appropriations have permitted. The unimproved portions afford less depth of channel than the improved sections and limit the available draft for the whole river to that required for passing its shoalest parts. Dredging and snagging operations will be required at many places, even should a more or less complete system of canalization be finally adopted, and for open-channel improvement continuous work and simultaneous operations will be absolutely necessary to produce effective results. The government plant should be largely increased in order that any great amount of work may be accomplished during the comparatively short periods to which effective operations must be limited each year on account of unfavorable river conditions. Several light-draft towboats, barges, and derrick boats for dike construction and removing rocks or other obstructions are all urgently needed before anything approximating satisfactory progress can be expected.

The available depth in the Ohio River varies greatly with the fluctuation in river stages. During the fiscal year the available depth has been below the average. This was due, however, to a long-continued drought in the fall of 1908.

The fluctuations in river stages are indicated by the following readings from characteristic river gauges:

	Highest.	Date.	Lowest.	Date.	Range.
	Feet.	1909.	*Feet.*	1908.	*Feet.*
Dam No. 6	32.2	Feb. 25	0.8	Sept. 28, 30	31.4
Wheeling, W. Va	33.9	May 3	.0	Sept. 30-Oct 9.	33.9
Parkersburg, W. Va	36.7	Feb. 27	.0	Sept. 28, Oct. 17-24.	36.7
Point Pleasant, W. Va	42.6	Feb. 27	.2	Oct. 2	42.4
Portsmouth, Ohio	49.8	Mar. 1	1.4	Oct. 4, 5	48.4
Cincinnati, Ohio	54.6	Feb. 28	2.5	Oct. 6, 7	52.1
Louisville, Ky. (head)	39.2	Feb. 27	2.2	Dec. 4	37.0
Evansville, Ind	43.2	Mar. 2	1.3	Oct. 11-16	41.9
Paducah, Ky	44.5	Mar. 5, 6	1.0	Oct. 20	43.5
Cairo, Ill	46.8	Mar. 6	4.3	Oct. 17-19	42.5

The available depth in channel may be considered 1 foot greater than gauge readings from Pittsburg to Louisville and 2 feet greater from Louisville to Cairo.

During the fiscal year no work was done to increase the available depth, but work was confined to the removal of snags and other obstructions and increasing the width of narrow low-water channels, thus bettering navigable conditions.

No estimate can be given of the effect of the improvement thus far made on freight rates. In this connection reference is made to the Report of Ohio River Board (H. Doc. No. 492, 60th Cong., 1st sess.), in which statements are made of present and prospective commerce and the effects of improvements on freight rates, etc.

In order to provide for navigation during comparatively low-water periods in winter, many of the existing dikes and dams will require to be kept in a state of repair, as the movable dams can not safely be operated during a time of even light-running ice, although properly protected steamboats may be able to navigate at such time. The severe losses to floating craft during recent years have shown the importance of maintaining certain of the harbors of refuge afforded by existing ice piers and the providing of others at carefully selected localities.

The commerce of the river during the past year, so far as indicated by statistics that the engineer officer in charge of the river has been able to obtain, was as follows: General merchandise, coal, etc., 8,498,754 tons, at an estimated value of $59,491,278; passengers, 3,960,965.

July 1, 1908, balance unexpended		$582,693.75
Amount allotted from appropriation by river and harbor act approved March 3, 1909		150,000.00
Received from sales, etc		224.92
		732,918.67
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$283,897.25	
For maintenance of improvement	21,760.00	
		305,657.25
July 1, 1909, balance unexpended		427,261.42
July 1, 1909, outstanding liabilities		3,604.74
July 1, 1909, balance available		423,656.68
July 1, 1909, amount covered by uncompleted contracts		90,741.39
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix D D 1.)

2. *Lock and Dam No. 37, Ohio River.*—The river and harbor act approved June 13, 1902, authorized the construction of this dam, at a cost not to exceed $1,050,000, and the river and harbor act of March 2, 1907, authorized the expenditure of $100,000 in excess of amounts theretofore appropriated or authorized, "provided that the said lock and dam shall be constructed with a view to a navigable depth of nine feet." The river and harbor act of March 3, 1909, further increased the authorizarion for this work by $150,000, making a total of $1,300,000. Of the continuing-contract authorizations, $150,000 is yet to be appropriated.

Work was carried on from July 1, 1908, to December 19, 1908, under very favorable conditions, and included the completion of lock chamber, lock walls (excepting the raised platform on lower pier head), lock gates, upper guide wall, filling and paving of esplanade, construction of sewers and catch basins, laying of air pipes, 552 linear feet of navigable pass with its wickets, etc., and the Kentucky abutment of dam. Work on the warehouse and power house, both of brick, terra cotta, concrete, and tile construction, was carried on during the season of

1909, with the result that both are now nearing completion. The following work was done and material placed during the year: 1,280 linear feet of cofferdam (20 feet wide); 108 temporary piling; 29,757 cubic yards ordinary excavation; 5,979 cubic yards deposit excavation; 2,140 cubic yards rock excavation; 6,673 cubic yards ordinary filling; 547 cubic yards stone filling; 20,463 cubic yards concrete masonry; 10,430 square yards brick paving; 775 linear feet open gutter; 22 catch basins; 2,120.7 linear feet sewers; 42,758 feet b. m. oak timber; 6,980 feet b. m. white pine timber; 8,522 feet b. m. yellow pine timber; 322 feet b. m. cypress timber; 407,144 pounds cast iron; 947,385 pounds wrought iron and steel; 87,272 pounds steel castings; 2,277 pounds bronze; 316 pounds Babbitt metal; 2,228 linear feet 3-inch, 4-inch, and 8-inch iron pipe; three 4-inch valves; one 4-inch cross; eight 4-inch elbows; 193 pounds brass pipe; 84 piles.

Under provisions of contract, 879,094 pounds of ironwork were delivered at the site and partial payment made thereon. Twenty-two thousand two hundred and thirty-eight and three-quarter barrels of American Portland cement were delivered during the year, and 24,165 barrels were used on the work, there being some left over from last year.

Under supplemental contract with the contractor, dated October 1, 1908, 1,291 cubic yards of concrete facing were placed on various slope walls in lieu of stone originally provided.

Under supplemental agreement with the contractor, dated August 28, 1907, the work of lowering the tracks of the lower gates of lock and slightly modifying the gate itself was completed, the following work being done and material placed: Lowering gate track and Poirée dam and raising top of gate; removing and replacing gate tracks, cover plates, and I-beams ($835); 548.91 cubic yards concrete removed; 476 cubic yards rock excavation; 713 cubic yards concrete masonry replaced; 5,296 pounds ironwork; 1,669 pounds tug levers and rods; 38 linear feet stopwater (jam) pipes; 529 holes drilled in old ironwork; 1,526 feet b. m. white pine timber; 268 feet b. m. oak timber.

The total expenditures on account of work to June 30, 1909, exclusive of outstanding liabilities, is $766,512.67.

It is proposed to apply the funds asked for the fiscal year 1911 for Lock and Dam No. 37, Ohio River, toward completion of navigable pass, bear traps, buildings, machinery, and other appurtenances of the lock and dam necessary to its operation.

July 1, 1908, balance unexpended	$469,492.13
Amount appropriated by sundry civil act approved March 4, 1909	230,000.00
	699,492.13
June 30, 1909, amount expended during fiscal year, for works of improvement	316,004.80
July 1, 1909, balance unexpended	383,487.33
July 1, 1909, outstanding liabilities	711.11
July 1, 1909, balance available	382,776.22
July 1, 1909, amount covered by uncompleted contracts	269,784.60
Amount (estimated) required for completion of existing project	150,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix D D 2.)

3. Operating snag boats on the Ohio River below the Pennsylvania state line.—The condition of the channel way of the Ohio, the necessity for continuous snag-boat work, and the benefits accruing therefrom to river commerce are plainly shown by the yearly reports of obstructions removed, which obstructions, if permitted to remain, would make navigation highly dangerous at ordinary stages and hazardous at any time.

The project for removing obstructions by a properly equipped snag boat was put in operation in 1876, the boat having been completed at a cost of $125,125.24, and the expense of operating having been borne by appropriations for improving Ohio River until 1890. The river and harbor act of September 19, 1890, provided $25,000 yearly for this purpose, and the act of June 3, 1896, increased the yearly appropriation to $50,000.

The amount expended on this work during the fiscal year ending June 30, 1909, was $34,090.98, the total expenditures up to the close of the present fiscal year, exclusive of outstanding liabilities, being $613,224.04. For report upon operation of snag boats on the Ohio River in the State of Pennsylvania, see page 623, following.

As far as practicable the removal of obstructions is carried on whenever permitted by the stage of water and the absence of dangerous ice; and during the last fiscal year the regular Ohio River snag boat *E. A. Woodruff* was in active service from July 1 to December 14, 1908, and from May 14 to June 30, 1909, traveling 4,098.25 miles and removing the following obstructions: 1,357 snags, aggregating 5,277.78 tons; 6 rocks, measuring 527.5 cubic feet; 1 cofferdam; 294.71 cords drift; and 57 wrecks, comprising 29 coal barges, 8 coal boats, 1 fuel barge, 1 wharf boat, 1 model barge, 1 tie barge, 2 pump boats, 1 gravel barge, 2 flatboats, 1 cinder barge, 1 sand barge, and the remains of 9 steamboats. One steamboat wreck was removed by hired dredge.

The snag boat *Woodruff* is a powerful and finely equipped vessel that does admirable service during moderate stages of water, but can do little or nothing when the river is at a stage of less than 4 feet, though it is at such stages that snagging operations should be prosecuted most advantageously.

It is extremely important that snagging operations should be extended to cover these low-water periods, and to this end it is recommended that the yearly appropriation for snagging, as provided for by the act of June 3, 1896, be increased to $100,000 for the fiscal year ending June 30, 1911, the additional $50,000 to be used in the building and equipment of one light-draft combination snag and derrick boat, adapted for use at even extreme low-water stages. This boat would form a part of the regular snagging plant, and would be operated from the yearly appropriation made for that purpose.

(See Appendix D D 3.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE PITTSBURG, PENNSYLVANIA DISTRICT.

This district was in the charge of Maj. H. C. Newcomer, Corps of Engineers, having under his immediate orders the following-named officers of the Corps of Engineers: Capt. A. E. Waldron to August 7, 1908, Capt. E. M. Adams to July 24, 1908, and First Lieut. Lewis M.

Adams the entire year. Division engineer, Col. Wm. T. Rossell, Corps of Engineers.

1. *Monongahela River, West Virginia.*—The Monongahela River is formed by the junction of the Tygarts Valley and West Fork rivers, about 1 mile south of Fairmont, W. Va., and flows in a generally northerly direction about 128 miles to its junction with the Allegheny River at Pittsburg, Pa. The improvement of the portion in West Virginia is considered to extend down the river as far as Lock No. 8 at the mouth of Dunkards Creek, Pennsylvania, about 4 miles north of the Pennsylvania State line, or a total distance of about 41 miles.

Navigation on this portion of the river in its original condition was impeded at high water by swift currents, the fall per mile being about 2 feet. At low stages it was obstructed by shoals and numerous gravel and rock bars. Steamboat navigation was practicable at high stages as far upstream as Morgantown. Occasionally a boat could go as far upstream as Fairmont, and downstream navigation of flats and small rafts was practicable at medium and high stages.

The original project for this portion of the Monongahela River was adopted in 1872, and contemplated the construction of Locks and Dams Nos. 8 and 9. This project was completed on November 8, 1899, with the result that boats drawing 5.2 feet of water could navigate the river at low water as far upstream as Morgantown, W. Va., the river having previously been slack watered from its mouth to Lock No. 8 by the Monongahela Navigation Company. The amount expended under this project was $436,900.

The existing project, adopted by Congress July 13, 1892, provides for the construction of six locks and dams, Nos. 10 to 15, inclusive, between Morgantown and Fairmont, W. Va., at an estimated cost of $1,275,000. Appropriations aggregating this amount have been made, and the sum of $107,463.86 was recovered from surety company on contract of C. I. McDonald for failure to complete Locks and Dams Nos. 10 to 15.

The amount expended under this project up to close of the fiscal year ending June 30, 1909, was $1,314,440.38, including $21.64 received from sales.

The condition of this work on June 30, 1909, was as follows:

Nos. 10 to 15, inclusive.—The locks and dams proper were completed and assigned to "Operating and care of canals," etc., in January, 1904. The lock houses and outbuildings have been completed, the lock grounds graded, and additional protection provided by strengthening the abutments and raising and lengthening the lower guide walls. Some further work is required on one of the abutments and the construction of one upper guide wall.

The completion of these six locks and dams extended slack-water navigation about 28 miles, from Morgantown to a point on the West Fork River 4 miles above Fairmont, W. Va., with a minimum navigable depth of 7 feet. The improvement should enable the people of the territory affected to transport coal, general freight, etc., almost uninterruptedly to market.

The greatest recorded flood height is 40 feet at Morgantown. Ordinary flood heights average about 22 feet on this portion of the river.

Traffic on this portion of the river is not heavy, but it has materially increased over that originally existing there. A line of packets plies the river between Pittsburg and Fairmont, and towboats operate as necessity requires. Since the opening of the locks there has been some development of coal mines and the shipment of coal by water in small quantities.

A statement of commerce and of the effect of the project on freight rates, so far as known, is given in the report for operating and care of locks and dams on Monongahela River, page 616.

References to more extended information, reports of surveys, etc., are given on page 467 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1908, balance unexpended	$68,045.12
June 30, 1909, amount carried to surplus fund	1,392.35
July 1, 1909, balance unexpended	66,652.77
July 1, 1909, outstanding liabilities	678.60
July 1, 1909, balance available	65,974.17

(Appendix E E 1.)

2. *Monongahela River, Pennsylvania.*—The improvement of this part of the river is considered to extend from Pittsburg to the mouth of Dunkards Creek, a distance of 87.5 miles. In its original condition, prior to 1840, it was navigable for steamboats only at high stages. A downstream navigation for light-draft flats and rafts was practicable at high and medium stages. The average fall per mile is about 0.9 foot and the minimum discharge about 160 cubic feet per second.

In 1833 Congress provided for a survey of the river from Pittsburg to Brownsville, a distance of about 57 miles. This survey was not followed by an appropriation for improving the river, and the legislature of Pennsylvania, by act of March 31, 1836, incorporated and authorized the Monongahela Navigation Company to improve the river from Pittsburg, Pa., to the Virginia state line, a distance of 91.5 miles. This company built seven locks and dams, producing slack water from Pittsburg to within 2 miles of the West Virginia state line.

The river and harbor act of June 3, 1896, authorized and directed the Secretary of War to institute and carry to completion proceedings for condemnation of all the property and appurtenances of the company. The property was acquired by the United States on July 7, 1897, at a cost of $3,761,615.46.

The amount expended on original and modified projects prior to operations under existing project was $3,769,073.88, including the purchase money.

The existing project, adopted in 1899, with subsequent modifications (see Annual Report of the Chief of Engineers for 1906, p. 515), provides for the enlargement and improvement of Lock No. 6 and some additional structures at Lock No. 3, for the rebuilding of Locks Nos. 2, 3, and 5, using in each case two parallel chambers, each 56 by 360 feet, and fixed concrete dams with movable tops, and for the acquisition of necessary land and construction of certain improvements at Locks Nos. 5 and 6; all at a total estimated cost of $2,194,605.

The amount expended up to the end of fiscal year ending June 30, 1909, was $1,906,205.90.

Work is being carried on under continuing contract appropriations at new Lock No. 5, all the funds authorized for this work having been appropriated.

The condition of work on June 30, 1909, was as follows:

Lock and Dam No. 2.—The lock, power house, guard and guide walls, with the exception of upper 105 feet of upper guide wall, were built under contract. The abutment and dam were built by hired labor. The river lock has been in operation since August 15, 1905, and the land lock since March 5, 1906.

The existence of cross currents at this lock renders it necessary to extend the upper guide wall upstream and the middle wall downstream to provide safe and convenient access to the locks, and an estimate of $43,000 is included in this report to cover the cost of the work.

Lock and Dam No. 3.—The lock, guard and guide walls, the power house, power plant, and two lock-keepers' houses were built under contract. The abutment and dam were built by hired labor, the whole work being complete except for the raising of the upper sill of the river lock. The river lock was placed in operation May 20, 1907, and the land lock October 23, 1907.

Lock and Dam No. 5.—The contractors for the lock have completed the land and middle walls and the lower guide wall, and have nearly completed the river wall and upper guide and guard walls, only a small portion of their work remaining to be done. The abutment was built by hired labor, and work was well under way on the foundations for the first section of the dam, representing about 220 feet in a total length of 555 feet.

Locks Nos. 3 and 6, and floating plant.—All of the necessary structures at Lock No. 3, and the improvements contemplated at Lock No. 6 have been nearly completed. All of the floating plant provided for in the existing project, consisting of a dredge and two dump scows and repair steamer with snagging appliances, has been completed and put in service. The necessary land has been acquired at Lock No. 6.

The greatest recorded flood height is 44 feet at Brownsville. Ordinary flood heights average about 30 feet on this portion of the river.

The traffic of the river is hampered and restricted by insufficient capacity and inconvenience at some of the old locks. This will not be overcome until the enlargement of Locks Nos. 1, 4, and 5 has been accomplished.

A statement of commerce and of the effect of the project on freight rates, so far as known, is given in the report for operating and care of locks and dams on Monongahela River, page 616.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to the extension of upper guide wall upstream and of middle wall downstream at Lock 2 ($43,000).

It is very important that this old Lock No. 4, built many years ago with dimensions that are now inadequate for the growing commerce of the river, should be rebuilt at the earliest practicable date, and it is therefore recommended that authorization be also given for the amount required to complete this work ($527,000), so that it may be carried on under continuing contract. This amount is larger than the estimate given in House Document No. 209, Fifty-eighth Congress, second session, the increase being necessary because of increased unit costs, etc.

A list of references to reports of examinations and surveys and other items of interest concerning this river are given on page 469 of Annual Report of the Chief of Engineers for 1905.

REBUILDING LOCK 2.

July 1, 1908, balance unexpended	$3,770.42
July 1, 1909, balance unexpended	3,770.42
Amount (estimated) required for completion of existing project	43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	43,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

REBUILDING LOCK 3.

July 1, 1908, balance unexpended	$19,489.03
Amount received from sale of condemned property	313.77
	19,802.80
June 30, 1909, amount expended during fiscal year, for works of improvement	7,192.06
July 1, 1909, balance unexpended	12,610.74
July 1, 1909, outstanding liabilities	18.67
July 1, 1909, balance available	12,592.07

REBUILDING LOCK 5.

July 1, 1908, balance unexpended	$537,406.91
Amount appropriated by sundry civil act approved March 4, 1909	200,000.00
Amount received from sale of blueprint maps	4.45
	737,411.36
June 30, 1909, amount expended during fiscal year, for works of improvement	472,261.51
July 1, 1909, balance unexpended	265,149.85
July 1, 1909, outstanding liabilities	68,762.81
July 1, 1909, balance available	196,387.04
July 1, 1909, amount covered by uncompleted contracts	62,267.45

LOCKS 3, 6, ETC.

July 1, 1908, balance unexpended	$3,803.93
July 1, 1909, balance unexpended	3,803.93

LOCKS 5 AND 6.

July 1, 1908, balance unexpended	$3,700.00
June 30, 1909, amount expended during fiscal year, for works of improvement	13.75
July 1, 1909, balance unexpended	3,686.25

CONSOLIDATED.

July 1, 1908, balance unexpended	$568,170.29
Amount received from sale of condemned property	313.77
Amount appropriated by sundry civil act approved March 4, 1909	200,000.00
Amount received from sale of blueprint maps	4.45
	768,488.51
June 30, 1909, amount expended during fiscal year, for works of improvement	479,467.32
July 1, 1909, balance unexpended	289,021.19
July 1, 1909, outstanding liabilities	68,781.48
July 1, 1909, balance available	220,239.71
July 1, 1909, amount covered by uncompleted contracts	62,267.45
Amount (estimated) required for completion of existing project	[a] 43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	[a] 43,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix E E 2.)

3. *Operating and care of locks and dams, Monongahela River.*—Statements of the original condition of the Monongahela River are contained in the summaries for Monongahela River, West Virginia and Pennsylvania. The slack-water system of the Monongahela River comprises 15 locks and dams. Locks Nos. 1 to 4, inclusive, are double locks; 5 to 15 are single locks. A table giving the dimensions of the locks, lengths of dams, and other data is given in the Annual Report of the Chief of Engineers for 1907, page 1691.

The dams extend slack water to a point on West Fork River 4 miles above Fairmont, W. Va., or a total distance of about 131 miles above the mouth of the Monongahela River at Pittsburg. Controlling depths at normal pool stages on the sills at the different old locks below Morgantown vary from 4 to 6.7 feet; on the new locks above that place they are uniformly 7 feet. During low stages of water depths of 7.5 to 8 feet are maintained below Dam No. 6 by placing flashboards on the dams.

Locks Nos. 1 to 7, inclusive, have been under operation and care since July 7, 1897, when they were purchased from the Monongahela Navigation Company; No. 8 since November 8, 1889; No. 9 since 1879; and Nos. 10 to 15, inclusive, since January, 1904.

The total amount expended for operating and care to June 30, 1909, was $2,675,692.40. The amount expended during the fiscal year ending June 30, 1909, was $231,966.81.

Under the provision of section 6 of the river and harbor act of March 3, 1909, a special allotment of $329,045 was made from the permanent indefinite appropriation for operating and care of locks and other works of navigation, for beginning the reconstruction of Lock and Dam 1, and preparations for this work are under way.

The amount expended under this allotment in the fiscal year 1909 was $9,208.10.

---

[a] For Lock No. 2 only.

Necessary repairs were made to the locks and dams and floating plant, and the locks were operated throughout the year, except when closed for limited periods for repairs, or on account of floods or ice.

The total number of lockages at the 15 locks for the calendar year 1907 aggregated 66,105, giving a total commerce through individual locks amounting to 27,388,211 tons and 188,248 passengers. Much of this commerce, of course, moved through several locks. Taking only the aggregate of the greatest items of the different kinds of freight passing up and down at any single lock, plus the coal mined and shipped in pools 1 and 2, which amount is manifestly less than the real movement of commerce, the total commerce of the Monongahela River for the year amounted to 9,667,229 tons and 28,164 passengers.

The effect on freight rates of the slack-water system of the Monongahela is very great. This is true for all manner of products, and particularly so for coal. For an average haul of 50 miles on the Monongahela River the price of coal delivered by river is $1.25 per ton, as compared with $1.40 per ton delivered by rail, making the river freight rate 15 cents per ton cheaper. As the haul increases the advantage of the river advances rapidly. As an example, the river freight rate on coal to a point 12 miles below Pittsburg is 2.5 mills per bushel, or 6.25 cents per ton, in barge-load lots, while the rail freight rate to the same point is 40 cents per ton, a difference in favor of river of 33.75 cents per ton. The effect on freight rates beyond the above, due to the rebuilding of Locks and Dams Nos. 2 and 3, will not be felt until the enlargement of Locks Nos. 1, 4, and 5 is accomplished, when larger cargoes will be towed by steamers and the freight rate reduced accordingly.

(See Appendix E E 3.)

4. Allegheny River, Pennsylvania, open-channel work.—The Allegheny River rises in northern Pennsylvania and flows northwestward into New York, and thence in a southerly direction into Pennsylvania to its junction with the Monongahela River at Pittsburg. The average fall per mile of the navigable portion is about 2.2 feet and the minimum discharge at Pittsburg is about 1,440 cubic feet per second. In its original condition the Allegheny River abounded in obstructions, such as bowlders, snags, islands, bars, and wide-spreading shoals, all of which rendered navigation at best hazardous and practicable only at such high stages of water as would enable craft to clear the obstructions.

The present project was adopted in 1878 and 1880 and contemplates the removal of the bowlders and snag obstructions and the construction of low dams and dikes to close secondary channels and concentrate the low-water flow on shoals.

The amount expended under this project to June 30, 1909, was $263,624.52, fully one-half of which was applied to maintenance.

The work that has been done enables navigators to operate safely on stages from 2 to 3 feet lower than formerly.

The present condition of the channel is generally satisfactory, having been largely cleared of the more objectionable obstructions, but to maintain its condition it is necessary to remove any bowlders or snags brought in by the tributaries or carried along by ice and freshets, and to make occasional repairs to the dikes and dams.

The greatest recorded flood height is 36.6 feet at Herr Island dam. Ordinary flood heights average about 30 feet.

Except on the lower 25 miles of the river the principal traffic is the downstream transportation of timber and lumber rafts, new coal-boat bottoms, barges and flats, usually loaded with tan bark, lumber, posts, railroad ties, and other timber products, and the towage of gravel, stone, sand, etc. Steamboating is not now conducted to any material extent above Kittanning.

The annual commerce of the river above slack-water improvements in course of construction is about 200,000 tons, extending over 230 miles from Tarentum, Pa., to Olean, N. Y.

The effect of the work on freight rates is not very noticeable, as the depth of water has not been increased, but the hazard of boating has been greatly decreased.

It is proposed to apply the $5,000 estimated as a profitable expenditure for the fiscal year 1911 to maintenance of the existing channel and works of improvement.

More detailed information, reports of surveys, etc., are given in the following Annual Reports of the Chief of Engineers: 1899, page 2411; 1902, page 1901; and 1905, page 1862.

July 1, 1908, balance unexpended		$2,290.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909		1,000.00
		3,290.80
June 30, 1909, amount expended for maintenance of improvement during fiscal year	$915.32	
June 30, 1909, amount carried to surplus fund	1,375.48	
		2,290.80
July 1, 1909, balance unexpended		1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, in addition to the balance unexpended July 1, 1909		5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix E E 4.)

5. *Allegheny River, Pennsylvania, construction of locks and dams.*—Prior to the completion, in 1885, of the Davis Island dam in the Ohio River, 5 miles below its head, it was impossible to navigate the Allegheny River with steam craft of lightest draft during low-water periods, which frequently continued for months at a time. Since then a navigable depth of 8 feet has been afforded by that dam, when raised, to Garrison ripple, 2 miles up the stream.

The present project for lock and dam construction, originally adopted in 1890 and subsequently extended in 1896, provides for the construction of three locks and dams, extending slack water from the mouth at Tarentum, a distance of 25 miles. Dam No. 1 is movable, of Chanoine type, with bear-trap weirs. Dams Nos. 2 and 3 are both fixed, the former being built of concrete on pile foundation and the latter of crib construction. The lock chamber at No. 1 is 55 feet by 286 feet 2 inches; at Nos. 2 and 3, 56 feet by 289 feet 6 inches. The estimated cost of the work is $1,658,226.63, including $210,000 for restoration of dam, etc., at Dam No. 3. In addition $95,000 will be required to cover the restoration of bank at Dam No. 3, made necessary by the flood of 1907, and the payment of damages to private property resulting from the failure of the abutment.

The amount expended to June 30, 1909, was $1,658,804.47; of this amount $10,000 was expended for maintenance.

The condition of the work on June 30, 1909, was as follows:

Lock and Dam No. 1 (Herr Island), about 1½ miles from the mouth.—This work was built under contract and has been in operation since January 1, 1903.

The dam was first raised June 2, 1903. One double lock-masters' house has been built under contract.

Lock and Dam No. 2 (Aspinwall), 7 miles from the mouth.—The lock has been built under contract and has been in operation since November 10, 1906. The abutment and dam have been built under contract, with the exception of a portion of the abutment, which was built by hired labor.

Lock and Dam No. 3 (Springdale), about 17 miles from the mouth.—The lock was built under contract and has been in operation since September, 1904. The abutment and dam were built under contract. In January, 1907, during a moderate flood stage, the abutment failed and a portion of the dam had to be blown up to limit the resulting damage to private property. The abutment and dam have been rebuilt and the bank partly restored by hired labor.

Two lock houses have been built under contract.

Some dredging will be required in each of the three pools to secure the projected minimum depth of 7 feet.

The greatest recorded flood height is 36.6 feet at Herr Island dam. Ordinary flood heights average about 30 feet.

For the calendar year 1908 the commerce reported on that part of the river under the improvement for slack-water navigation was 536,129 tons of freight and 9,636 passengers.

The completion of these locks and dams will be of immense benefit to the manufacturing plants along the banks of the Allegheny River within their reach, by reason of connecting them with the harbor of Pittsburg and with the coal fields of the Monongahela River.

The effect of the project on freight rates is given in report on operating and care of locks and dams on Allegheny River.

In addition to the funds appropriated by the river and harbor act of March 2, 1907, for repair and reconstruction of Dam No. 3, an estimate of $95,000 is submitted by the district officer as the further amount required for restoration of the bank at the abutment of Dam No. 3 and for the payment of damages to private property resulting from the failure of the abutment in January, 1907. All of the claimants, except two with whom satisfactory agreements could not be made and whose claims, estimated at $365.25, have not been included, have signed agreements binding themselves to accept reasonable sums in full payment of their claims. These amounts aggregate $46,767.21, including 6 per cent interest for one year to cover delay in payment not contemplated in the agreements, and the remaining $48,232.79 is needed to restore land that was washed away. An appropriation of the amount ($95,000) required for this purpose is recommended for the favorable consideration of Congress.

July 1, 1908, balance unexpended	$96,464.19
Amount received from sale of condemned property	137.85
Amount received from sale of blueprint maps	.60
Amount received by transfer	5,000.00
	101,602.64
June 30, 1909, amount expended during fiscal year for works of improvement	96,845.48
July 1, 1909, balance unexpended	4,757.16
July 1, 1909, outstanding liabilities	1,326.10
July 1, 1909, balance available	3,431.06
July 1, 1909, amount covered by uncompleted contracts	825.00

(See Appendix E E 5.)

6. *Operating and care of locks and dams, Allegheny River, Pennsylvania.*—Statement of the original condition of the Allegheny River is contained in the preceding summary for Allegheny River, Pennsylvania.

Locks Nos. 1, 2, and 3 were under the appropriation for operating and care all the year. Dimensions of locks and other data are given in Annual Report of the Chief of Engineers for 1907, page 1705.

Dam No. 1 is movable and was the first to be completed in the series of three authorized by Congress for the Allegheny River; its pool provides a navigable depth of 5 to 6 feet for a distance of about 5.5 miles. Dams Nos. 2 and 3 are both fixed, the former being built of concrete on pile foundation and the latter of crib construction. Dam No. 2 forms a pool about 10 miles long, while Dam No. 3 extends slack water about 8 miles farther to the projected site of Dam No. 4 at Natrona.

Lock No. 1 has been under operating and care since January 1, 1903; No 2 since November 10, 1906, and No. 3 since November 29, 1904.

The total amount expended for operating and care to June 30, 1909, was $257,549.80. The amount expended during fiscal year 1909 was $37,839.51.

The locks and dams were operated throughout the year as occasion required.

The traffic through locks and dams, Allegheny River, during the calendar year 1908 was as follows: Lock and Dam No. 1, 374,310 tons and 7,578 passengers; Lock and Dam No. 2, 138,440 tons and 1,507 passengers; Lock and Dam No. 3, 23,379 tons and 551 passengers. The tons represent short tons of 2,000 pounds.

The operation of the locks and dams on the Allegheny River, providing a system of slack-water navigation in connection with Pittsburg Harbor, will tend to give manufacturing plants in this section the benefit of the cheap river rates on coal and other supplies. This benefit, however, can not be realized to any considerable extent until the low bridges on the lower Allegheny River are raised sufficiently to remove the very serious obstruction to navigation that they now present.

(See Appendix E E 6.)

7. Construction of locks and dams in Ohio River, Pennsylvania (40.5 miles).—The Ohio River, Pennsylvania, in its original condition had a low-water channel depth varying from 1 foot at Pittsburg to 2 feet at the Ohio State line, the average slope being about 1.25 feet per mile and the minimum discharge at the head about 1,600 cubic feet per second. Under the original project for open-river improvement, work was conducted on this portion of the river at a number of shoals.

Under the original project for lock and dam construction, adopted in 1875, Dam No. 1 was begun in 1877 and completed in 1885, at a cost of $940,000. The present project, in its original form, was adopted by Congress September 19, 1890, and, with subsequent modifications, provides for the construction of Locks and movable Dams Nos. 2, 3, 4, 5, 6, and 7, so as to secure a navigable depth of 9 feet in the pools formed thereby, the locks to have available dimensions of 110 by 600 feet, at a total estimated cost of $6,321,376. Appropriations aggregating $5,369,376 have been made, and $15,684.74 has been realized from other sources. The sum of $75,000 additional will be required to place the grounds at Locks Nos. 2–5 in suitable condition.

The amount expended under present project to the close of the fiscal year ending June 30, 1909, was $5,356,309.79.

The work was done partly under continuing-contract system, and the total authorization has been appropriated.

The condition of work on June 30, 1909, was as follows:

Locks and Dams 2, 3, 4, 5, and 6 were all practically completed. The dams were first raised on the following dates: No. 1, October 7, 1885; No. 2, November 12, 1906; No. 3, June 25, 1908; No. 4, June 30, 1908; No. 5, November 21, 1907; No. 6, August 17, 1904.

Lock and Dam No. 7.—The site for this work has been secured and plans are partly made. No field work of construction has been done on account of lack of funds.

The completed dams, Nos. 1–6, inclusive, give continuous slack water, when raised, from Pittsburg to Merrill, Pa., a distance of about 28.9 miles.

The greatest recorded flood height is 34.2 feet at Davis Island dam. Ordinary flood heights average about 28 feet on this portion of the river.

A statement of commerce and of the effect of the project on freight rates, so far as known, is given in the report for operating and care of locks and dams, Ohio River, page 624.

It is proposed to apply the amount estimated as a profitable expenditure for the fiscal year 1911 to the completion of necessary work on the lock grounds at Locks Nos. 2, 3, 4, and 5 ($75,000), which includes filling in the grounds now much below grade and the construction of concrete paving.

The work of constructing Lock and Dam 7 is most urgently needed in order to utilize more effectively the improvements already made on the upper Ohio River, the portion of the river immediately above that location being specially suited for harborage purposes, and it is recommended that authority be given to complete it under the continuing contract system. No estimate for the existing 6-foot project is included amongst those submitted for the fiscal year 1911, pending action by Congress on the new plans now before it for providing 9-foot navigation (see H. Doc. No. 492, 60th Cong., 1st sess., in which the estimated cost of Dam No. 7 in the 9-foot project is given as $1,094,800).

Reference to more detailed information, reports of surveys, etc., are given on page 522 of the Annual Report of the Chief of Engineers for 1906.

DAMS NOS. 2, 3, 4, AND 5.

July 1, 1908, balance unexpended	$18,919.77
Amount received from sale of condemned property	324.90
Amount received by transfer of public property	250.00
Amount received on account of judgment against E. J. Hingston	5,062.60
	24,557.27
June 30, 1909, amount expended during fiscal year, for works of improvement	2,841.92
July 1, 1909, balance unexpended	21,715.35
July 1, 1909, outstanding liabilities	10.10
July 1, 1909, balance available	21,705.25
Amount (estimated) required for completion of existing project	75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	75,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 6.

July 1, 1908, balance unexpended	$8,069.30
June 30, 1909, amount expended during fiscal year, for works of improvement	133.36
July 1, 1909, balance unexpended	7,935.94

DAM NO. 7.

July 1, 1908, balance unexpended	$4,755.38
June 30, 1909, amount expended during fiscal year, for works of improvement	18.18
July 1, 1909, balance unexpended	4,737.20
Amount (estimated) required for completion of existing project	[a] 952,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended	$31,744.45
Amount received from sale of condemned property	324.90
Amount received by transfer of public property	250.00
Amount received on account of judgment against E. J. Hingston	5,062.60
	37,381.95
June 30, 1909, amount expended during fiscal year, for works of improvement	2,993.46
July 1, 1909, balance unexpended	34,388.49
July 1, 1909, outstanding liabilities	10.10
July 1, 1909, balance available	34,378.39
Amount (estimated) required for completion of existing project	1,027,000.00

---

[a] For 6-foot project, see page 621 (last paragraph).

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	$75,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix E E 7.)

8. *Dredging Ohio River, Pennsylvania.*—An allotment of $20,800 was made June 12, 1905, from the appropriation of $300,000 made by act of March 3, 1905, for the general improvement of the Ohio River, for the removal of the bar in upper approach to Lock No. 6. This bar was removed by the excavation of 35,161 cubic yards of material at a contract cost of 19 cents per cubic yard. On August 30, 1905, a reallotment of $10,350 from the allotment for dredging pool No. 6 was made for dredging in pools Nos. 3 and 4, Ohio River. Under this allotment the channel at Whites riffle, above Lock No. 3, was straightened out, and the bar immediately below Lock 3 was removed. The total amount of material handled was 48,917 cubic yards.

The amounts expended on these works to June 30, 1909, are as follows:

Dredging pools Nos. 3 and 4	$6,475.24
Dredging pool No. 6	8,693.16
Total	15,168.40

DREDGING POOLS 3 AND 4.

July 1, 1908, balance unexpended	$3,858.55
June 30, 1909, amount expended during fiscal year, for works of improvement	1,533.79
July 1, 1909, balance unexpended	2,324.76

DREDGING POOL 6.

July 1, 1908, balance unexpended	$806.84
July 1, 1909, balance unexpended	806.84

CONSOLIDATED.

July 1, 1908, balance unexpended	$4,665.39
June 30, 1909, amount expended during fiscal year, for works of improvement	1,533.79
July 1, 1909, balance unexpended	3,131.60

See Appendix E E 8.)

9. *Operating snag boats on Ohio River in the State of Pennsylvania.*—The project adopted July 27, 1905, provides for the removal of snags, wrecks, and similar obstructions in portion of the Ohio River in the State of Pennsylvania. This work was carried on under allotments made from the permanent appropriation for operating snag boats on Ohio River.

The amount expended on this work to June 30, 1909, is $7,369.91, of which $2,300.97 was expended during the past fiscal year.

There were removed during the year one coal boat and one barge.

(See Appendix E E 9.)

10. Operating and care of locks and dams, Ohio River, Pennsylvania.—Statement of the original condition of the Ohio River in Pennsylvania is found on page 621 of this report.

Locks and Dams Nos. 1 to 6, inclusive, were under the appropriation for operating and care during the whole fiscal year. The dams are all movable and are the first ones to be completed in the series that is projected for the improvement of the Ohio River. The dimensions of the locks, with other data, are given in Annual Report for 1907, page 1715 et seq.

Dam No. 1, at Davis Island, was designed to give a depth of 6 feet in Pittsburg Harbor, which has since been increased to 10 feet over certain portions of the harbor by dredging. Dams Nos. 2 to 6, inclusive, are designed to give navigable depths of 9 feet in their respective pools. The aggregate length of these pooled portions of the river is 28.9 miles.

These locks and dams were placed under operating and care. as follows: No. 1, October 7, 1885; No. 2, October 13, 1906; No. 3, February 1, 1908; No. 4, February 1, 1908; No. 5, November 21, 1907; No. 6, August 3, 1904.

The total amount expended for operating and care to June 30, 1909, was $785,964.15. The amount expended during the fiscal year ending June 30, 1909, was $119,954.97.

Dam No. 1 was up during the fiscal year 3 times, aggregating 219 days; Dam No. 2, 3 times, 222 days; Dam No. 3, 3 times, 222 days; Dam No. 4, 4 times, 205 days; Dam No. 5, 3 times, 219 days; and Dam No. 6, 4 times, 219 days.

The locks were operated as occasion required and necessary repairs made for maintenance of the works.

The traffic for the calendar year 1908, as measured by the commerce through Lock and Dam 1, amounted to 3,060,835 tons of 2,000 pounds.

The effect of the project on freight rates has been partly discussed in the report for operating and care of locks and dams, Monongahela River.

Davis Island dam. forming as it does the pool of Pittsburg Harbor, has lent its great part to the general effect on freight rates to and from Pittsburg. The effect on rates of the operation of Dams Nos. 2 to 6, inclusive, should be felt locally for all supplies coming from Pittsburg Harbor, and to some extent also for through traffic, since they will increase from 25 to 50 per cent the number of days in the year on which tows may be moved down the river from Pittsburg.

The great future benefit of the above project will be felt only when the slack-water system is extended far enough down the Ohio River to permit continuous navigation during all but the winter season. This improvement, it has been estimated, will cause a saving in freight rates over the present rail rates on such produce as coal, iron, steel, sugar, timber, molasses, tobacco, etc., of over 3 mills per ton-mile to the 8,000,000 people living in territory commercially contiguous to the Ohio and Mississippi systems.

(See Appendix E E 10.)

11. *Harbor at Pittsburg, Pa.*—This harbor comprises that portion of the Ohio River lying above Davis Island dam, a length of 4.7 miles; that portion of the Allegheny River lying between its mouth and Aspinwall, a length of 7 miles, and that portion of the Monongahela River lying between its mouth and McKeesport, a distance of 15.5 miles; total length of harbor, 27.2 miles. That portion of the harbor most used as such, and called the lower harbor, lies between the Davis Island dam and Dam No. 1 of the Allegheny and Monongahela rivers and measures 8 miles of river. In its original condition the lower harbor depths were from 3 to 4 feet on natural mean low river, and very often still lower stages caused suspension of navigation.

Since the completion of Davis Island dam, in 1885, the maximum draft which could be carried over the shoalest place was scant 8 feet at pool stage. Parts of the channel and harbor are from 10 to 12 and from 16 to 20 feet in depth. The average widths of the harbor at pool-full surfaces are: On the Ohio, about 1,100 feet; on the Allegheny, about 930 feet, and at different parts of the Monongahela, from 750 to 950 feet. The capacity of the harbor is impaired by shoal places and high dumps projecting from the banks. The use for harbor purposes of that portion of the harbor in the Allegheny River above the Sixth Street Bridge is practically nullified by the low bridges on that part of the stream. The clear heights of these bridges above their respective pool surfaces are from 27½ to 35½ feet. The least height, with chimneys down, of the packets that ply between Pittsburg and points on the Ohio, Kanawha, and Muskingum rivers is 45 feet. The average height of the Ohio River towboats, with chimneys down, is 44 feet. The height of a suitable packet for the Allegheny River is about 33 feet, and of a suitable towboat, about 28 feet. The result is that practically none of the coal and iron or steel products intended for southern shipments have been loaded or harbored in the Allegheny River. The removal of the Union Bridge at the mouth of the river has opened up this portion of the harbor as far as the Sixth Street Bridge, a distance of about one-half mile.

In 1858 the State of Pennsylvania, through a board of commissioners, made a detailed survey of the rivers at and near Pittsburg and laid down on the maps high and low water lines intended to define the banks and limit the use of the same by riparian proprietors. These lines were referred to stone monuments on the ground. No means, however, were provided for preserving the monuments nor for preventing filling in the river beyond these lines.

In 1894 a board of engineer officers recommended certain harbor lines for the harbor of Pittsburg, from the Davis Island dam to Brilliant, Allegheny River, and to Homestead, Monongahela River. The recommended lines generally followed the actual banks as they existed at that time. These lines were approved by the Secretary of War January 29, 1895. An extension of these lines on the Monongahela River from Homestead to McKeesport was approved by the Secretary of War April 3, 1902.

The original project for improvement was adopted by the river and harbor act of March 3, 1899, and provided, with subsequent modifications made during the progress of the work, for dredging a channel through the lower harbor (below dams No. 1 on the Allegheny and Monongahela rivers) where needed 10 feet deep at pool and 500 feet wide below Smithfield Street Bridge, Monongahela River, and of less width above this bridge and in the Allegheny River, limited by lines from ends of channel spans of the adjoining bridges, except at the Pan Handle railroad bridge, where the dredged channel, under modified project, was to have a width of 570 feet, including two channel spans; for raising the old riprap dam across Brunot Island back channel, Ohio River; for removing abandoned structures and unauthorized and obstructive fillings projecting from the banks beyond the harbor lines; for marking of harbor lines, and for inspecting and patrolling the harbor. Appropriations aggregating $110,662.90 were made and expended on this work.

The existing project provides for maintenance of the harbor at an annual estimated cost of $10,000. The amount expended under this project to June 30, 1909, was $39,894.74.

The greatest recorded flood height is 35.5 feet at Pittsburg. Ordinary flood heights average about 28 feet.

The principal commercial uses of the harbor are the mooring of coal fleets awaiting a rise in the Ohio for proceeding to destination on that river or on the lower Mississippi, the mooring of timber rafts and boat bottoms coming down the Allegheny River on rises, the delivery of coal and other materials to mills, furnaces, steel plants and yards, and the accommodation of the several packet lines plying on the three rivers and whose routes terminate at the harbor. Besides coal, considerable quantities of steel rails, cotton ties, sheet iron, wire, nails, etc., are shipped by barges to the lower river markets.

Commercial statistics.

Calendar year.	Products.	Passengers.	Calendar year.	Products.	Passengers.
	Tons. [a]			*Tons.* [a]	
1900	8,141,451	884,415	1905	12,269,020	603,716
1901	10,916,489	817,800	1906	12,927,975	271,450
1902	12,252,405	996,500	1907	14,395,816	533,280
1903	12,240,360	702,269	1908	9,090,146	267,043
1904	9,373,448	604,477			

[a] 2,000 pounds.

The improvement of this harbor is so closely connected with the slack-water system of the rivers emptying into it that it might well be said that, as far as effect on freight rates is concerned, this project is one and the same as the projects for the improvements of said rivers.

It is proposed to apply the $10,000 estimated as a profitable expenditure for the fiscal year 1911 to the maintenance of the harbor in accordance with the approved project.

References to reports of establishement of harbor lines and projects for maintaining this harbor are given in Annual Reports of the Chief of Engineers for 1905, page 474, and 1906, page 520.

July 1, 1908, balance unexpended	$1,901.69
Amount received from sale of blueprint maps	5.65
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	5,907.34
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,749.39
July 1, 1909, balance unexpended	3,157.95
July 1, 1909, outstanding liabilities	44.99
July 1, 1909, balance available	3,112.96
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E E 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE WHEELING, WEST VIRGINIA, DISTRICT.

This district was in the charge of Capt. F. W. Altstaetter, Corps of Engineers. Division engineer, Col. Wm. T. Rossell, Corps of Engineers.

1. *Locks and dams in Ohio River between the Pennsylvania state line and Cincinnati.*—A general description of the Ohio River is contained in the Annual Report of the Chief of Engineers for 1896, page 2062. The system of improvement of this river by movable dams was approved by Congress in the act of March 3, 1875 (construction of dam at Davis Island—first dam below Pittsburg). The act of September 19, 1890, provided for the construction of a dam at or near Beaver, Pa., known as No. 6. The above represent practically the original projects for the slack-water system of the Ohio. The original project for Dams Nos. 8 to 18, inclusive, is contained in Annual Report of the Chief of Engineers for 1899, page 2361, and that for Dams Nos. 19 and 26 in Annual Report of the Chief of Engineers for 1902, page 1867.

Congress, in the river and harbor act of March 3, 1905, made provision for 9-foot navigation in the pools formed by Dams Nos. 2, 3, 4, 5, and 6, and for an examination of and report on the river by a board of engineers with regard to the method and means of improvement which will meet the demands of traffic, present and prospective. This report is contained in House Document No. 492, Sixtieth Congress, first session.

The river and harbor act of March 2, 1907, made provision for a navigable depth of 9 feet at Dams Nos. 8, 11, 13, 18, and 26, and for increased cost as follows: Dam No. 8, $1,211,845; Dam No. 11, $1,158,343; Dam No. 13, $1,286,778; Dam No. 18, $933,000; and Dam No. 26, $1,200,000. An increased depth at Dam No. 19 has not been authorized and the estimate of cost remains at $950,000.

When the dams are completed they will provide a navigable depth of 9 feet at intervals between Pittsburg, Pa., and Gallipolis, Ohio.

The amount expended on the dams mentioned below to June 30, 1909, is as follows:

Dam No. 8	$743,527.42
Dam No. 11	710,108.56
Dam No. 13	1,064,234.70
Dam No. 18	769,173.55
Dam No. 19	54,007.20
Dam No. 26	111,899.35
Total	3,452,950.78

The following is a statement of the condition of the works:

Dam No. 8.—The lock and guide walls are completed. Three hundred and fifty linear feet of the navigable pass next to the lock was completed and work on the second section of the pass is well underway. A contract was entered into for completing the dam, but no permanent work was placed.

Dam No. 11.—With the exception of paving the esplanade the work provided for under contract for building lock and guide walls was completed. The navigable pass was practically completed except the removal of the cofferdam. A contract was entered into for completing the dam and preparations made for beginning work.

Dam No. 13.—The lock and dam were completed, lock gates placed, and power house built. Contracts have been entered into for furnishing and installing the machinery required for operating the lock and dam.

Dam No. 18.—The lock and dam were completed and the lock gates placed. Owing to failure of the contractor the dam was completed by hired labor. A power house is building under contract. Contracts have been entered into for furnishing and installing the machinery required for operating the lock and dam.

Dam No. 19.—The abutment for the dam was completed and a contract entered into for constructing 500 feet of navigable pass. Preparations were made for beginning work on the pass.

Dam No. 26.—Work at this site is being carried on by hired labor. The abutment for the dam was completed and preparations made for constructing lock and dam. The cofferdam for this work is well underway.

Conditions for construction work were unusually favorable during the first half of the fiscal year, although there were times when the moving of floating plant was interfered with due to extreme low water.

Continuing contracts have been authorized for carrying on the work at Dams Nos. 8, 11, 13, 18, and 26. The total amount of the authorization for each of Dams Nos. 8 and 11 has been made available. The balance of the authorization remaining to be appropriated is as follows:

Dams Nos. 13 and 18	$175,000
Dam No. 26	555,000

The canalization of this section of the river is not far enough advanced to benefit navigation and therefore has had no effect on freight rates.

For commercial statistics, see reports for improving Ohio River and operating and care of Davis Island Dam.

To carry on the work without interruption, funds should be made available as follows:

At No. 11.—For lock keepers' houses, Poirée dams, dredging, etc. These items can not be provided for from the funds now available.

At No. 19.—For continuing work on dam and constructing lock and guide walls.

At No. 26.—For continuing construction of lock and dam.

DAM NO. 8.

July 1, 1908, balance unexpended	$356,832.54
Amount appropriated by sundry civil act approved March 4, 1909	364,000.00
	720,832.54
June 30, 1909, amount expended during fiscal year, for works of improvement	252,514.96
July 1, 1909, balance unexpended	468,317.58
July 1, 1909, outstanding liabilities	895.58
July 1, 1909, balance available	467,422.00
July 1, 1909, amount covered by uncompleted contracts	67,381.17
Amount (estimated) required for completion of existing project	[a] 65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 65,000.00

DAM NO. 11.

July 1, 1908, balance unexpended	$511,356.25
Amount appropriated by sundry civil act approved March 4, 1909	300,000.00
	811,356.25
June 30, 1909, amount expended during fiscal year, for works of improvement	363,121.81
July 1, 1909, balance unexpended	448,234.44
July 1, 1909, outstanding liabilities	936.62
July 1, 1909, balance available	447,297.82
July 1, 1909, amount covered by uncompleted contracts	86,956.64
Amount (estimated) required for completion of existing project	[b] 74,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[b] 74,000.00

---

[a] Due to the fact that, since the date of preparing this estimate and submitting the same to the Secretary of War, favorable bids have been received for certain parts of this dam, more work can be undertaken with the funds now available, and it is believed that further appropriation for Dam No. 8 is no longer necessary.

[b] Due to the fact that, since the date of preparing this estimate and submitting the same to the Secretary of War, favorable bids have been received for certain parts of this dam, more work can be undertaken with the funds now available, and it is believed that the amount of this estimate for further appropriation for Dam No. 11 may be reduced to $48,000.

DAM NO. 13.

July 1, 1908, balance unexpended	$314,050.56
Amount transferred from allotment for Dam No. 18	6,000.00
Amount appropriated by sundry civil act approved March 4, 1909	160,000.00
	480,050.56
June 30, 1909, amount expended during fiscal year, for works of improvement	331,458.64
July 1, 1909, balance unexpended	148,591.92
July 1, 1909, outstanding liabilities	1,987.26
July 1, 1909, balance available	146,604.66
July 1, 1909, amount covered by uncompleted contracts	4,665.70
Amount (estimated) required for completion of existing project	([a])

DAM NO. 18.

July 1, 1908, balance unexpended	$293,648.33
Amount transferred to allotment for Dam No. 13	6,000.00
	287,648.33
Amount appropriated by sundry civil act approved March 4, 1909	60,000.00
Amount received from sales	1,337.93
	348,986.26
June 30, 1909, amount expended during fiscal year, for works of improvement	229,821.88
July 1, 1909, balance unexpended	119,164.38
July 1, 1909, outstanding liabilities	2,998.42
July 1, 1909, balance available	116,165.96
July 1, 1909, amount covered by uncompleted contracts	26,264.95
Amount (estimated) required for completion of existing project	([a])

DAM NO. 19.

July 1, 1908, balance unexpended	$206,128.68
Amount received from sale	252.90
	206,381.58
June 30, 1909, amount expended during fiscal year, for works of improvement	35,135.88
July 1, 1909, balance unexpended	171,245.70
July 1, 1909, outstanding liabilities	764.08
July 1, 1909, balance available	170,481.62
July 1, 1909, amount covered by uncompleted contracts	111,305.00
Amount (estimated) required for completion of existing project	725,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	400,000.00

---

[a] The balance of the continuing-contract authorization for Locks and Dams Nos. 13 and 18 is $175,000; but it is now expected to complete these works with the funds available without further appropriations.

DAM NO. 26.

July 1, 1908, balance unexpended	$326,025.93
Amount appropriated by sundry civil act approved March 4, 1909	300,000.00
	626,025.93
June 30, 1909, amount expended during fiscal year, for works of improvement	92,925.28
July 1, 1909, balance unexpended	533,100.65
July 1, 1909, outstanding liabilities	10,956.66
July 1, 1909, balance available	522,143.99
July 1, 1909, amount covered by uncompleted contracts	53,206.43
Amount (estimated) required for completion of existing project	555,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for work of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended	$2,008,042.29
Amount received from sales	1,590.83
Amount appropriated by sundry civil act approved March 4, 1909	1,184,000.00
	3,193,633.12
June 30, 1909, amount expended during fiscal year, for works of improvement	1,304,978.45
July 1, 1909, balance unexpended	1,888,654.67
July 1, 1909, outstanding liabilities	18,538.62
July 1, 1909, balance available	1,870,116.05
July 1, 1909, amount covered by uncompleted contracts	349,779.89
Amount (estimated) required for completion of existing project	1,594,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 839,000.00

(See Appendix FF 1.)

2. *Little Kanawha River, West Virginia.*—A description of the original condition of the river and its availability for purposes of commerce are given in the Annual Report of the Chief of Engineers for 1875, page 740.

The original project provided for removing rocks, snags, and overhanging and fallen trees above Burning Springs, W. Va., at a cost of $7,300, as adopted by Congress on August 14, 1876. The act of Congress of June 14, 1880, made provision for the construction of a lock and dam about 2 miles above Burning Springs. This lock was opened to navigation on December 2, 1891, and has since been maintained under the indefinite appropriation for operating and care of canals and other works of navigation. Funds are appropriated from time to time for maintaining the present channel by the removal of obstructions which have re-formed.

---

[a] Due to the fact that, since the date of preparing this estimate and submitting the same to the Secretary of War, favorable bids have been received for certain parts of Dams Nos. 8 and 11, more work can be undertaken with the funds now available, and it is believed that this estimate of $839,000 may be reduced to $748,000.

Congress, in the act of March 3, 1905, provided $75,000 for the purchase and $88,000 for the repair of Locks and Dams Nos. 1–4, owned by the Little Kanawha Navigation Company, the project for which is contained in House Document No. 309, Fifty-eighth Congress, second session, as given in the Annual Report of the Chief of Engineers for 1904, page 2607.

Of the $81,000 made available by act of March 2, 1907, $79,500 is for the improvement of the structures purchased from the Little Kanawha Navigation Company, as set forth in detail on page 534 of the Annual Report of the Chief of Engineers for 1906; $1,000 for maintenance of improvement above Burning Springs; and $500 for making a preliminary survey for a lock and dam above Lock No. 5. The survey has been completed.

An allotment of $30,000 for completing the repairs to Locks Nos. 1 and 3 was made from the amount appropriated by the river and harbor act of March 3, 1909.

The amount expended to June 30, 1909, is $405,665.70, of which $2,554.23 was applied to maintenance, $75,000 to acquisition, $114,129.13 to repair of Locks and Dams Nos. 1–4, and $500 to survey above Lock No. 5 ($186.10 was received from sale of unserviceable property).

A small force was employed during October, 1908, in removing obstructions from the channel between Creston and Grantsville, a distance of 76 miles. Work done under War Department permits was inspected.

Repairs to Lock and Dam No. 2 were completed, and the lock at No. 3 repaired. New guide cribs were built at Locks Nos. 3 and 4; and a spur dike built at Lock No. 1. Obstructions were removed from the pools. The land required at Locks Nos. 1 and 4 was purchased, and steps taken to procure that required at Locks Nos. 2 and 3.

The maximum draft which can be carried at mean low water over the shoalest place in that section of the river under maintenance of improvement is 6 inches. During high water steamboats run to Glenville, 102 miles from the mouth. The head of gasoline-boat and push-boat navigation is Burnsville, 120 miles from the mouth; rafting, however, extends some miles above.

Slack-water navigation extends from the mouth of the river to Creston, W. Va., a distance of 48 miles, and provides a depth of 4 feet. Owing to the poor condition of the structures purchased from the Little Kanawha Navigation Company, this depth has not been maintained during the low-water season, as the repairs provided for have not been completed.

Between Creston and Burnsville the high-water mark ranges from 28 feet at Creston to 24 feet at Burnsville. During very dry seasons there are only a few inches of water on the shoals. The highest stage reached during the year was 25.45 feet at Lock No. 5.

A statement of the commerce is contained in the report for operating and care of locks and dams on Little Kanawha River, West Virginia. (See p. 634 of this report.)

Gasoline boats which formerly plied above Lock No. 5 are now running to Parkersburg. Some new gasoline boats have been built.

Until the extensive repairs contemplated at Locks and Dams Nos. 1 and 3 are completed, river navigation will not have a decided effect on freight rates by rail. The rates by river were reduced in an amount equal to the tolls charged by the navigation company since the Government assumed control of Locks Nos. 1–4.

It is estimated that $500 can be profitably expended during the fiscal year ending June 30, 1911, for maintaining the channel above Burning Springs, W. Va., by removing obstructions which re-form from time to time.

Reports on an examination of the river between Lock No. 5 and Burnsville and on the locks and dams "not owned by the Government" are contained in the Annual Report of the Chief of Engineers for 1904, pages 2597 to 2617.

Report on survey for a lock and dam above the location of existing Lock No. 5, required by the river and harbor act of March 2, 1907, is printed in House Document No. 917, Sixtieth Congress, first session.

The river and harbor act of March 3, 1909, provides for an examination of the "Little Kanawha River with a view to the modification of the existing system of locks and dams and its further improvement," and report thereon will be submitted to Congress at its next session.

ABOVE LOCK NO. 5.

July 1, 1908, balance unexpended	$1,208.66
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	641.13
July 1, 1909, balance unexpended	567.53
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	500.00

PURCHASE AND REPAIR OF LOCKS NOS. 1–4.

July 1, 1908, balance unexpended	$7,951.10
Amount allotted from appropriation by river and harbor act approved March 3, 1909	30,000.00
	37,951.10
June 30, 1909, amount expended during fiscal year, for works of improvement	7,878.87
July 1, 1909, balance unexpended	30,072.23
July 1, 1909, outstanding liabilities	727.43
July 1, 1909, balance available	29,344.80
July 1, 1909, amount covered by uncompleted contracts	4,643.02

BETTERMENTS, LOCKS NOS. 1–4.

July 1, 1908, balance unexpended	$65,738.28
June 30, 1909, amount expended during fiscal year, for works of improvement	12,439.64
July 1, 1909, balance unexpended	53,298.64
July 1, 1909, outstanding liabilities	160.00
July 1, 1909, balance available	53,138.64

CONSOLIDATED.

July 1, 1908, balance unexpended		$74,898.04
Amount allotted from appropriation by river and harbor act approved March 3, 1909		30,000.00
		104,898.04
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$20,318.51	
For maintenance of improvement	641.13	
		20,959.64
July 1, 1909, balance unexpended		83,938.40
July 1, 1909, outstanding liabilities		887.43
July 1, 1909, balance available		83,050.97
July 1, 1909, amount covered by uncompleted contracts		4,643.02
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		500.00

(See Appendix F F 2.)

3. *Operating and care of locks and dams on Little Kanawha River, West Virginia.*—The lock and dam known as "No. 5" was built under the appropriation for improving the Little Kanawha River, West Virginia, being a part of the original project as given in the Annual Report of the Chief of Engineers for 1875, page 740.

Locks and Dams Nos. 1–4 were purchased from the Little Kanawha Navigation Company and transferred to the Government on November 1, 1905.

The five locks and dams provide slack-water navigation for a distance of 48 miles from the mouth.

The total amount expended in operating and care of these works to June 30, 1909, is $72,636.39, of which $10,338.43 was expended during the past fiscal year.

A table of the important features, giving location, year when finished, etc., of the locks and dams, is contained in the Annual Report of the Chief of Engineers for 1903, page 1720.

Navigation was suspended through Lock No. 3 seventy-five days on account of repairs, and sixty days on account of low water. At Lock No. 5 navigation was suspended ninety-seven days, seventy-four days of which were due to low water.

The repairs to Locks Nos. 1 and 3 are provided for under improving Little Kanawha River, West Virginia. Those to Lock and Dam No. 2 were completed, and its operation and care is therefore a charge under the indefinite appropriation. Repairs were made to the lower step of Dam No. 4 and to gate valves and dam of Lock No. 5.

With the exception of the dam and guide cribs at Lock No. 5, Locks and Dams Nos. 2, 4, and 5 are in good condition. The dam and guide cribs at No. 5 require rebuilding. However, it is not thought that this work will be necessary during the coming fiscal year.

During the calendar year 1908 the commerce that passed Lock No. 5 amounted to 49,707 tons, of which 42,172 tons consisted of timber products (saw logs, ties, etc.) and 76 tons of coal.

(See Appendix F F 3.)

4. *Kanawha River, West Virginia.*—A description of the condition of the river, the projects, and the general work accomplished (the locks and dams being in operation) are contained in the Annual Report of the Chief of Engineers for 1900, page 490.

The amount expended under the original project is $50,000; that expended under the present project to June 30, 1909, is $4,181,501.89 ($2,949.15 was received from sales, etc.).

Plans are nearly completed for guide walls for upper approaches to Locks Nos. 4 to 11, and considerable progress made on plans for snag boat and quarter boat for use on this river. Work under this appropriation was suspended, however, due to the provisions contained in section 10 of the sundry civil act approved March 4, 1909, and no other work was undertaken during the year, although under authority of joint resolution approved June 25, 1909, the balance of this appropriation was again made available.

For reasons stated in the appendix the district officer recommends the reconstruction of the ice pier at the mouth of the river at an estimated cost of $24,000.

The maximum draft that can be carried at the shoalest part of the slack-water system at mean low water is 6 feet. The highest stage reached during the year was 16 feet at Charleston; the lowest 0.3 foot at the falls. Loup Creek shoal, about 90 miles from the mouth of the river, is the head of navigation for steamboats and other craft.

For commercial statistics, see report for operating and care of locks and dams on Kanawha River, West Virginia (below).

The improvement of this river having been gradual, it is difficult to give the exact effect the improvement has had upon freight rates. There is no doubt, however, that freight rates, where transportation by water is available, are regulated thereby. A reduction in the passenger rate by railroads has materially decreased the number of passengers traveling on the Kanawha River packets.

A report of the examination of the unimproved section of the river, about 4½ miles between Lock No. 2 and Kanawha Falls, is contained in the Annual Report of the Chief of Engineers for 1904, page 2587.

July 1, 1908, balance unexpended	$46,583.98
Amount received from sale	58.40
	46,642.38
June 30, 1909, amount expended during fiscal year, for works of improvement	3,331.98
July 1, 1909, balance unexpended	43,310.40

(See Appendix F F 4.)

5. *Operating and care of locks and dams on Kanawha River, West Virginia.*—Under the projects for improving the Kanawha River, ten locks and dams were built, two fixed dams and eight movable (Chanoine type), extending slack-water navigation for a distance of 90 miles from the Ohio River. The maintenance of these works is provided for by the indefinite appropriation for operating and care of canals and other works of navigation.

The location of each lock and dam and the year in which completed are given in the Annual Report of the Chief of Engineers for 1899, page 428.

A table of important features, giving available lengths and widths of locks, lengths of passes, etc., is contained in the Annual Report of the Chief of Engineers for 1903, page 1724.

The total amount expended in operating and care of these works to June 30, 1909, is $975,698.94, of which $100,915.32 was expended during the past year.

Navigation was practically continuous throughout the year, except at Lock No. 3, where it was suspended eight hours by high water, and at Locks Nos. 4 and 5, where it was suspended thirteen and fifteen days, respectively, on account of repairs.

The repairs made during the fiscal year 1909 to keep the structures in good condition were more extensive than for any previous year. This is due to the number of years the locks and dams have been in service, part of the system having been completed in 1880.

The commerce for the calendar year 1908 amounted to 1,035,401 tons, with a valuation of $4,243,619. Of the foregoing there were 965,000 tons of coal and 38,274 tons of timber products, valued at $820,250 and $165,260, respectively.

(See Appendix F F 5.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND CINCINNATI, OHIO, DISTRICT.

This district was in the charge of Lieut. Col. J. G. Warren, Corps of Engineers, having under his immediate orders to August 28, 1908, First Lieut. Arthur Williams, Corps of Engineers. Division engineer, Col. Wm. T. Rossell, Corps of Engineers.

1. Muskingum River, Ohio.—The original condition of the waterway and its availability for purposes of commerce are given in the Annual Report of the Chief of Engineers for 1900, Part 1, page 488. For more extended information reference is also made to the Annual Report of the Chief of Engineers for 1904, Part 1, page 477.

The original project, adopted August 11, 1888, provided for the construction of a lock at Dam No. 9, Taylorsville, Ohio, and the reconstruction of Lock No. 10, Zanesville, Ohio. The repair and extension of the levee above Dam No. 10, Zanesville, Ohio, was added by the act of July 1, 1898. Raising the crest of Dam No. 9 and building four lock houses was added by the act of June 13, 1902.

With the exception of the reconstruction of a lock at Zanesville—which was indefinitely postponed and the money originally appropriated for it diverted to other purposes—all of this work has been completed. The amount expended prior to operations under existing project is $137,339.45.

The existing project, adopted March 3, 1905, provides for the raising of the crest of Dam No. 3; building a lock master's dwelling at Lock No. 10, and rebuilding Lock and Dam No. 11. The first two items have been completed, and Lock and Dam No. 11 was partially constructed under contract.

The amount expended under existing project up to the close of the fiscal year ending June 30, 1909, is $114,915.65.

The miter-sill depth at pool level is the controlling mean low-water depth of the system; this is 6 feet at Locks Nos. 1 to 10 and 7½ feet and 9 feet, respectively, for the lower and upper sills at Lock No. 11.

The present head of slack-water navigation is 84 miles above the mouth of the river. The pool to be formed by the construction of Dam No. 11 will extend the navigable head about 7 miles. At ordinary high stages the stream is navigable for light draft boats to its head, at Coshocton, Ohio, 107 miles above its mouth at Marietta, Ohio.

The usual variation in the level of water surface is 38 feet at Lock No. 1 and 24 feet at Lock No. 10.

The commercial statistics are reported under the head of operating and care of locks and dams on Muskingum River (see below).

It is believed that this improvement has had no material effect on freight rates.

July 1, 1908, balance unexpended	$136,128.54
Received from sales	54.45
	136,182.99
June 30, 1909, amount expended during fiscal year for works of improvement	83,521.41
July 1, 1909, balance unexpended	52,661.58
July 1, 1909, outstanding liabilities	161.96
July 1, 1909, balance available	52,499.62
July 1, 1909, amount covered by uncompleted contracts	38,131.00

(See Appendix G G 1.)

2. *Operating and care of locks and dams on Muskingum River, Ohio.*—The original condition and scope of this improvement is described in the Annual Report of the Chief of Engineers for 1901, Part 1, pages 485 and 486. For more extended information reference is also made to the Annual Report of the Chief of Engineers for 1904, Part 1, page 478.

Under allotments from the indefinite appropriation for operating and care of canals and other works of navigation there had been expended up to June 30, 1909, a total sum of $1,818,650.29, and an additional sum of $17,190.44 in building a protection wall at Zanesville and altering certain bridges at Taylorsville and Marietta, Ohio. The amount expended during the year ending June 30, 1909, was $52,858.39.

The principal work has been dredging bars and channels; making repairs to locks and dams and their appurtenances, lock houses and grounds, and floating plant; rebuilt, in timber, above pool level, both leaves of the upper gates at Lock No. 1; replaced the wooden guide crib below the land wall of lock, 30.5 feet in length, with a reenforced concrete retaining wall; replaced guard crib below the river wall, 25 feet in length, with concrete wall, and repaired lower apron and crest of dam at Lock No. 2; replaced guide piling below the land wall of lock; reconstructed, with reenforced concrete, timber guard crib below the river wall of lock; reconstructed, in concrete, the wooden storehouse and waiting room at Lock No. 3; resheeted the lower apron of dam over 23 feet of its length; repaired and completed the plumbing in lock master's dwelling, and replaced flood-damaged woodwork of the exterior and interior of dwelling at Lock No. 4; replaced timber guide crib 61 feet in length, below the land wall of lock, with a reenforced concrete retaining wall; resheeted 61 feet of the crest, 5 feet of the slope, and 20 feet of the lower apron of dam at Lock No. 5; repaired discharge valve in land wall of lock; restored elevation of dam by raising crest from 2 to 14 inches over 100 feet of its length at Lock No. 6; reconstructed, in concrete, conduit, and completed about 85 per cent of the repairs to the left bank of the canal at Lock No. 7; repaired discharge valve in river wall of lock; restored, with rubblestone, the embankment at lower end of terreplein of lock at Lock No. 8; repaired and restored canal embankment at Lock No. 9; extended, with reenforced concrete, the revetment of canal bank above the land wall of lock about 100 feet; reconstructed, with reenforced concrete, the revetment of the right bank of canal at Lock No. 10; the tentative harbor lines established at Zanesville, Ohio, were approved by the Secretary of War under date of June 25, 1909.

The total commerce for the calendar year 1908 was approximately 54,000 tons, valued at $1,900,000, and 44,000 passengers.

(See Appendix G G 2.)

3. Big Sandy River and Levisa and Tug Forks, West Virginia and Kentucky.—For more extended information concerning the early history of this improvement, reference is made to the following Annual Reports of the Chief of Engineers: For the year 1875, pages 756–769; for the year 1904, Part 1, page 479, and for the year 1905, Part 1, pages 488–489.

In their original condition this river and its forks were much obstructed by rocks, bars, snags, and leaning trees. During the low-water period of each year navigation was practically suspended.

The original project was adopted July 18, 1878, and provided for the removal of rocks, snags, and overhanging trees from the Big Sandy River and its forks. The construction of a lock and fixed dam below the junction of the two forks and near Louisa, Ky., was added by the act of June 14, 1880, and in 1891 was modified to admit of the construction of a movable instead of a fixed dam.

The work of clearing the forks of obstructions is carried on from year to year as funds are made available.

The amount expended on original and modified projects prior to operations under existing project, exclusive of maintenance on Levisa and Tug Forks, was $380,590.66.

The existing project, adopted March 3, 1899, contemplates carrying slack water from the Ohio River to Pikeville, on Levisa Fork, and to the mouth of Pond Creek, on Tug Fork, by the construction of 21 locks and dams, at an estimated cost of $4,725,000. Of these locks and dams 10 are proposed for the Levisa Fork, 8 for Tug Fork, and 3 for the main river. The survey made for this improvement developed the fact that only 2 locks and dams would be required for the main river.

The raising of the crest of Dam No. 3, at Louisa, Ky., was added by the act of June 13, 1902, at an estimated cost of $35,000.

The improvement at the mouth of the Big Sandy River by the construction of regulating works was added by the act of March 3, 1905, at a cost of $40,000.

The construction of a steel service bridge at Lock No. 1, Big Sandy River, was added by the act of March 2, 1907, at a cost of $7,000.

The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1909, was as follows:

Big Sandy River, general improvement, including maintenance	$955,502.44
Levisa Fork, maintenance	32,192.41
Tug Fork, maintenance	31,284.06

And at that date all work of this project applicable to the main river, Catlettsburg to Louisa, was completed, with the exception of the steel service bridge at Lock No. 1, which has been deferred for reasons set forth on page 606 of the Annual Report of the Chief of Engineers for 1908.

Lock No. 1, Tug, and Lock No. 1, Levisa, fork, have been completed, and Dam No. 1, Tug Fork, under contract dated July 22, 1908, and Dam No. 1, Levisa Fork, dated July 29, 1908, were partially completed.

With the exception of the service bridge at Lock No. 1, which is provided for by a specific appropriation, the work is being carried on under the continuing-contract system, and the balance of the authorization remaining to be appropriated is $25,000. This amount, in addition to the unexpended balance on June 30, 1909, can be profitably expended in the fiscal year ending June 30, 1911, in the extension of benefits by the construction, and partial completion of the accessories, of Dam No. 1, Tug Fork, and Dam No. 1, Levisa Fork.

In connection with the work under contract for constructing Dam No. 1, Tug Fork, and that covered by contract for constructing Dam No. 1, Levisa Fork, unforeseen conditions have presented themselves which will materially increase the cost of completing these works. Quicksand has been encountered, which will greatly increase the amount of excavation and deposit and, in addition to the authorization of $25,000 contained in the river and harbor act of March 3, 1909, an additional appropriation of $25,000 is recommended, that amount being considered necessary to complete the work as originally contemplated and to provide a maneuvering boat at each lock, estimated to cost $5,000 each.

An additional appropriation of $3,000 is recommended for the construction of a steel service bridge at Lock No. 1, Big Sandy River, the appropriation of $7,000 contained in river and harbor act of March 2, 1907, being deemed insufficient for reasons explained on page 606, Annual Report of the Chief of Engineers for 1908.

For reasons stated in the appendix to this report, the district officer considers a small dredging plant necessary for the operation and maintenance of this improvement, and estimates the cost of same at $20,000. It is recommended that funds be appropriated for the construction of this plant.

Three locks and dams on the Big Sandy River have been completed and opened to navigation. They provide a minimum depth of 6 feet on their lower miter sills, except at Lock No. 1, Catlettsburg, Ky., where the depth on the lower miter sill depends upon the stage in the Ohio River, and is uncertain and will remain so until a dam is placed in the Ohio River immediately below Catlettsburg.

The minimum draft that can be carried over the shoalest portions of the forks at mean low water is uncertain and changeable, and can not be definitely stated owing to the constant movement of the bottom and the fact that the obstructions naturally renew themselves.

It is deemed advisable that provision should be made for the necessary surveys to locate sites and for acquisition of land required for additional locks and dams, to be constructed under the adopted project, in order to avoid delays incident to such work after appropriations for actual construction have been made.

Commercial statistics are reported under the head of operating and care of locks and dams on Big Sandy River, West Virginia and Kentucky (see below).

The Big Sandy River is navigable by steamer from Catlettsburg, the mouth of the river, up to Louisa, Ky., a distance of 27 miles, and from there to Chapman, Ky., on Levisa Fork, a distance of 9 miles, and to Saltpetre, W. Va., on Tug Fork, a distance of 4 miles. For pole boats, rafts, etc., the head of present navigation is taken at Pond Creek on Tug Fork and at Pikeville on Levisa Fork.

It is believed that the work thus far accomplished on this improvement has had no material effect on freight rates.

Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 612, Annual Report of the Chief of Engineers for 1908.

July 1, 1908, balance unexpended		$271,583.26
Received from sales		25.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909		50,000.00
		321,608.76
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$172,096.64	
For maintenance of improvement	245.27	
		172,341.91
July 1, 1909, balance unexpended		149,266.85
July 1, 1909, outstanding liabilities		1,427.75
July 1, 1909, balance available		147,839.10
July 1, 1909, amount covered by uncompleted contracts		119,473.66
Amount (estimated) required for completion of existing project		3,705,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.		[a] 28,000.00

(See Appendix G G 3.)

4. *Operating and care of locks and dams on the Big Sandy River, West Virginia and Kentucky.*—For more extended information reference is made to the following Annual Reports of the Chief of Engineers: For the year 1904, Part 1, page 481, and for the year 1905, Part 1, page 490.

Under the allotments from the indefinite appropriation for operating and care of canals and other works of navigation there has been expended up to June 30, 1909, a total sum of $123,889.94. The amount expended during the year ending June 30, 1909, was $42,152.51.

---

[a] Of this amount, $25,000 is for continuing contract work authorized by the river and harbor act of March 3, 1909, and $3,000 for completing steel service bridge at Lock No. 1, Big Sandy River.

The principal work has been clearing the channels and lock approaches of snags and other obstructions; making repairs to locks, lock gates, operating machinery, dams, lock houses, and floating plant; installed butterfly valves in upper lock gates; sodded slope back of land wall of lock at Lock No. 1; constructed one new lock house at Lock No. 2; completed the following works, which were undertaken last year: Constructed bank protection below abutment; constructed new steel lock gates and new storehouse at Lock No. 3. The following new plant was purchased: One gasoline launch; 1 pump for use in cleaning deposits from lock walls, etc.; 1 push boat; and machinery for equipping new machine shop at Lock No. 3.

The total commerce for the year 1908 was approximately 111,168 tons, valued at $762,714.88, and 447 passengers.

(See Appendix G G 4.)

5. *Kentucky River, Kentucky.*—For more extended information, reference is made to the Annual Report of the Chief of Engineers for the year 1906, Part 1, pages 541 and 542. At the time the United States assumed control of the Kentucky River the improvement that had been made by the State of Kentucky, which included five locks and fixed dams, was found to be in a dilapidated and almost worthless condition. Portions of Dams Nos. 1 and 2 on the lower part of the stream were gone entirely, so that navigation was suspended.

The original and existing project was adopted in 1879 (Annual Report of the Chief of Engineers for 1879, pp. 1398–1422) and provides for repairing and rebuilding the five old locks and dams, removing snags, logs, and other obstructions, and extending 6-foot slack-water navigation from the mouth of the river to the Three Forks, a distance of about 261 miles.

The amount expended to June 30, 1909, was $3,094,100.81.

The result of this expenditure was the repair and the rebuilding of five old locks and dams constructed by the State; the construction of Locks and Dams Nos. 6, 7, 8, 9, 10, and 11; the purchase of sites for these and for Locks and Dams Nos. 12, 13, and 14, and the partial construction of Locks and Dams Nos. 12 and 13; construction of dam at Beattyville, Ky., and survey to determine the amount of damage by flowage to private property by reason of the construction of these works.

This work is being carried on under the continuing-contract system and the total amount authorized for this improvement has been appropriated.

The present unexpended balance will become exhausted with the completion of Lock No. 13, with the exception of a possible balance of $50,000; in addition thereto an appropriation of $165,000 will be necessary for the construction of the dam and abutment.

The estimated cost of Lock and Dam No. 14 is $415,650, not provided for in any existing legislation.

The construction of Locks and Dams Nos. 9 and 10 has caused damages to the highways of Madison County by backwater in Tates Creek and Otter Creek. Tates Creek enters the Kentucky River about one-half mile above Lock 9. There is a county road crossing this creek a few hundred feet above the mouth, which is the principal outlet for a large number of residents dwelling on the left-hand side going up this creek. Since the construction of Dam No. 9 this crossing has been rendered useless. In order to restore the crossing, a bridge will have to be constructed. From estimates already obtained it is thought that a suitable bridge can be built for approximately $3,500, and an appropriation of this amount is therefore recommended. Otter Creek is situated one-half mile below Ford, Ky., and one-half mile above Dam No. 10. Since the construction of this dam the county road running along this creek has been rendered impassable. This road meets the Richmond and Boonesboro (Ky.) turnpike and is the principal outlet for a large number of families scattered along this creek. For the purpose of restoring this road to public traffic an appropriation of $2,500 is recommended. This work constitutes an item of contingent expense that was not foreseen when the estimate of cost of constructing these locks and dams was prepared, and an appropriation of $6,000 to cover the cost of the additional work indicated is a proper charge to this improvement and should be provided in addition to sums heretofore authorized.

The greatest draft which can be carried at mean low water from Lock No. 1 to a point 2 miles above Irvine, Ky. (a distance of 220 miles), which is at present the head of slack-water navigation, is 5.5 feet. Above this point no boats can run at a low stage.

Ordinary low-water depth through Lock No. 1 and to the Ohio River, 4 miles below, is 6 feet or more, but at extreme low water only about 2½ feet can be carried over the lower sill of Lock No. 1. The usual variations of level of water surface are from 23 to 40 feet and occasionally much more.

The old locks, Nos. 1 to 5, inclusive, built by the State, have 145 feet available length and 38 feet width. The new locks, from No. 6 up, have available lengths of from 146 to 148 feet and are 52 feet in width.

The principal commerce of the river is timber, much of it loose logs, and the improvement is rather detrimental to this than otherwise. The logs are damaged in passing the dams, and in their turn cause much damage to the works—are a prolific source of snags and of discouragement to any steamboat traffic that might develop.

Commercial statistics in detail are given in the report for operating and care of locks and dams on Kentucky River (see Appendix G G 6).

The unexpended balance and appropriation recommended will be applied to construction of Locks and Dams Nos. 12 and 13 for extension of benefits.

There are not likely to be any decided changes in the volume or character of the commerce benefited until the improvement is carried to the head of the river, where it is hoped that coal lands may be developed and the product shipped by river. The development of coal lands, with the resulting traffic, is the specific purpose to which the expenditure will be applied. It is believed that the project has so far had no material effect on freight rates.

July 1, 1908, balance unexpended	$544,881.44
Received from sales	168.00
Amount appropriated for sundry civil act approved March 4, 1909	210,000.00
	755,049.44
June 30, 1909, amount expended during fiscal year, for works of improvement	166,660.97
July 1, 1909, balance unexpended	588,388.47
July 1, 1909, outstanding liabilities	910.00
July 1, 1909, balance available	587,478.47
July 1, 1909, amount covered by uncompleted contracts	496,152.33
Amount (estimated) required for completion of existing projcet	655,650.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	165,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix G G 5.)

6. *Operating and care of locks and dams on Kentucky River, Kentucky.*—At the time the United States acquired possession of the five locks and dams on this stream, in 1880, navigation, then extending for a distance of 87 miles upstream, was practically suspended on account of deterioration of the works. These five locks and dams were built by the State of Kentucky in 1836–1839, and from 1880 to 1885 were extensively repaired by the United States under appropriations for improving Kentucky River, Kentucky. Since then extensive repairs have been made under the indefinite appropriation of 1884 for operating and care of canals, etc., and Locks and Dams Nos. 6, 7, 8, 9, 10, and 11 have been constructed. Additional information will be found in the Annual Reports of the Chief of Engineers for 1906, Part 1, page 543, and for 1907, Part 1, pages 568–569.

Under allotments from the indefinite appropriation for operating and care of canals and other works of navigation there has been expended up to June 30, 1909, a total sum of $1,771,957.14. The amount expended during the year ending June 30, 1909, was $135,750.95.

The principal work has been dredging bars and channels; making repairs to locks, lock gates, operating machinery, dams, lock houses, and floating plant; constructing, in concrete, 255 feet of crest of dam, raising the height of dam 1 foot; constructing timber grillage between piers near lock entrance; reconstructing 150 linear feet of apron at toe of dam at Lock No. 1; replacing decayed timber and washed out riprap stone in upper guide crib; rebuilding, in timber, upper abutment crib at Lock No. 2; reconstructing, in concrete, 220 linear feet of downstream face of dam; rebuilding, in concrete, upper abutment crib at Lock No. 3; renewing worn-out and torn-off sheeting of dam, and repairing derrick at coal tipple; removing lower river crib preparatory to reconstructing same; commencing the reconstruction of dam at Lock No. 4; replacing worn-out and torn-off sheeting of dam at Lock No. 5; constructing 1,650 feet wire fence around grounds and repairing gates at Lock No. 6; reconstructing in concrete, lower river crib; rebuilding upper guide pier and repairing valves at Lock No. 7; reconstructing, in concrete, lower river crib; placing derrick stone at toe of dam at Lock No. 8; placing backing behind new dam at Lock No. 9; protecting abutment from scour at Lock No. 10; constructing, under contract, one additional dwelling at Lock No. 11; under contract dated September 25, 1908, the new towboat (with snagging appliances) *Kentucky* was constructed and placed in commission June 3, 1909; this contract involved the purchase of the U. S. steamer *General O. M. Poe* for the sum of $1,000; an additional towboat was placed under contract under date of April 1, 1909; extensive repairs were made to dredge *No. 1*, derrick boat *No. 2*, and three barges under an emergency contract; U. S. dredge *No. 2* (old) was sold, under date of November 18, 1908, for the sum of $750, and new dredge, *No. 2*, was completed under contract for the machinery only, the hull being built by the United States. The following new plant was purchased: One No. 4 Gates crusher; one 35-horsepower boiler, and one Emerson steam pump.

The total commerce for the year 1908 was approximately 318,565 tons, valued at $5,001,470, and 11,546 passengers.

(See Appendix G G 6.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE LOUISVILLE, KENTUCKY, DISTRICT.

This district was in the charge of Capt. Harry Burgess, Corps of Engineers, to September 3, 1908; of Capt. Lytle Brown, Corps of Engineers, from September 3, 1908, to April 27, 1908; and temporarily in the charge of Lieut. Col. J. G. Warren, Corps of Engineers, since the latter date. Division engineer, Col. Wm. T. Rossell, Corps of Engineers.

1. *Falls of the Ohio River at Louisville, Ky.*—Improvements under this title have included the enlargement of the basin immediately above the locks of the Louisville and Portland Canal, the enlargement of the head of the canal, and straightening, deepening, and controlling the water flow in the Indiana Chute channel.

The work of enlarging the basin above the canal rocks was completed in 1893.

The original conditions at the other localities are more conveniently and fully described under separate headings, as follows:

Head of Louisville and Portland Canal.—Previous to 1883 the approach to the canal at its upper end, above the Louisville Bridge Company's bridge at Fourteenth street, was so narrow as to constitute a source of much expensive delay to the large quantity of traffic which came down the river on ordinary rises. The canal proper from Ninth to Fourteenth streets was only 100 feet wide and curved between the two points, so that progress was slow and accidents frequent and unavoidable. The greater part of the dike marking the north side of the approach to the canal was submerged when the river reached a stage of 8.4 feet, upper canal gauge, and at stages of 9 feet or more a strong current set out from the shore, thus carrying many vessels against the dike and, at high enough stages, over it onto the rock ledges. This approach was 1,800 feet long and varied in width from 400 feet at the upper end to 100 feet opposite Ninth street. Its area was wholly insufficient for the required breaking and rearrangement of tows preparatory to entering or leaving the canal.

Indiana Chute.—This is the main channel of the river by which commerce passes over the falls when the stage of water is such as to permit navigation via that route. Originally it was very crooked, with swift currents and whirls, filled with dangerous rocky points projecting from the sides and bottom, and it could be navigated only at stages of 11 feet or more, upper canal gauge. Even at such stages the services of special skilled pilots of long local experience and having intimate knowledge of the channel conditions were essential for reasonably safe passage through it.

Projects.—The original project for the enlargement of the head of the Louisville and Portland Canal was adopted in 1883 and proposed the enlargement of the canal, beginning at a point a short distance below the railroad bridge at Fourteenth street and extending eastwardly to the cross dam, so as to not only straighten and widen the canal proper, but also provide ample space for the necessary rearrangement of tows about to enter or leave the canal. This was slightly modified in 1885, so far as the location of the new north wall was concerned. A revision of the project was made by a Board of Engineer officers January 28, 1890, and approved by the Chief of Engineers January 31, 1890. This revision modified the area formerly proposed to be excavated and determined the number and kinds of structures, etc., to be erected. As approved, it provided for enlarging the canal on its northerly side from a point 725 feet below the railroad bridge at Fourteenth street, where the width of the canal was abruptly increased from 90 feet to 210 feet. This latter width is then gradually increased through a distance of nearly 2,800 feet to 325 feet at the head of the canal proper, at which point the enlargement is expanded into a capacious basin or harbor 1,200 feet wide and practically parallel to the Kentucky shore. The structures proposed were a new retaining wall on the north side of the canal, a movable dam about 800 feet long, a fixed dam extending from the movable dam at the westerly end of the basin to the south abutment of the movable dam in the Middle Chute opening of the cross dam, the excavation of rock within designated limits to the same grade as the canal bottom, the construction of certain walls and slope revetment on the south side of the canal, and the removal of the old structures within the limits of the proposed enlargement. Under date of March 31, 1899, a further modification of some of the details of the project was considered by a Board of Engineer officers and their recommendations approved by the Chief of Engineers April 8, 1899. These later modifications, together with the work outlined in the report approved January 31, 1890, constitute the existing project toward the completion of which operations are now directed. The totals of estimates under the original project and the several revisions are as follows:

Project of 1883, page 1539, Annual Report of the Chief of Engineers for 1883	$1,335,363.00
Revision approved January 31, 1890, page 2217, Annual Report of the Chief of Engineers for 1890	710,230.40
Modification approved April 8, 1899, page 2545, Annual Report of the Chief of Engineers for 1899	300,391.92
A revision of the latter estimate was made November 13, 1900, approved by the Chief of Engineers November 17, 1900, and amounted to	398,359.12

The foregoing relates particularly to the improvements at the head of the Louisville and Portland Canal.

Prior to January 31, 1890, there was no specific comprehensive project for the systematic improvement of the Indiana Chute channel, although much work, consisting of the removal of some of the more dangerous rock ledges, had been done under estimates and allotments from appropriations for improving Ohio River. On the date just mentioned the project submitted by a Board of Engineer officers for the radical improvement of this chute was approved by the Chief of Engineers. This project had for its object the widening and deepening of the channel by rock excavation to specified grades within certain limits and the control of water flow in the channel by means of dikes, etc., so as to make this channel available for descending navigation drawing 6½ feet at stages of 8 feet, upper canal gauge. However, only a part of the work necessary for the purpose in view was included in the estimate accompanying the report of the Board, it being stated:

> As the exact knowledge of the results of that work [i. e., the work estimated for in the Board's report] would be of great importance in fixing the details of location and cross section of the additional works that will be required, it would be as well to leave the determination of the additional work above the bridge to a later day.

The estimates for work on this chute since the adoption of a specific project therefor are as follows:

Project approved January 31, 1890	$138,610.97
Modification approved April 8, 1899	74,320.98
Revision of estimate approved by the Chief of Engineers November 17, 1900	129,651.99

A consolidation of the projects for the enlargement at the head of the canal and the improvement of the Indiana Chute was authorized by the Chief of Engineers June 28, 1897, and since that date funds have been provided for work at both localities under one title of appropriation.

Work under that part of the project relating to the Indiana Chute having been completed, a Board of Engineer officers was assembled to determine, as anticipated in the project of 1890, what further work was essential to provide the requisite depth necessary to facilitate the passage of traffic through this channel. The report of the Board was submitted December 16, 1901, and approved by the Chief of Engineers December 30, 1901. The items of additional work found to be necessary to produce the desired result and the estimated cost thereof are as follows:

Submerged dam at Whirlpool Point (large stone), 2,500 cubic yards, at $3	$7,500
Raising movable dam north of canal wall	2,500
Removing old dam and building movable dam, 1,000 feet, at $75	75,000
Longitudinal contracting dikes (concrete), 22,300 cubic yards, at $12	267,600
Submerged dams below bridge (concrete), 3,000 cubic yards, at $20	60,000
Rock excavation, 3,200 cubic yards, at $3.50	11,200
Contingencies, 10 per cent	42,380
Total	466,180

For this latter work the Board prescribed the order in which it should be done, and stated that it was possible that a part of the work might become unnecessary if certain results were produced by the submerged dam at Whirlpool Point, and in that event about $125,000 would probably be saved from the estimated cost.

Subsequently, in House Document No. 492, Sixtieth Congress, first session, the Ohio River Board recommended the omission of all of the foregoing items, except that for removing the old dam and building a movable dam at the head of the falls, and in lieu of such omitted items proposed the following to increase the facilities for passing the falls:

(1) To widen the narrow portion of the canal to 170 feet, thus permitting the passage of a down-bound tow of loaded coal boats and an up-bound tow of empty coal boats, each tow 3 abreast; (2) to construct a new single-lift concrete lock south of and by the side of the present lock, available dimensions of the chamber to be 85 feet by 600 feet, thus permitting the passage at one lockage of 9 coal boats, or 12 coal barges; (3) to create a pool above the falls with elevation of pool surface at 412.004 (9 feet on upper canal gauge), by the replacing of the wooden dam between Middle and Indiana chutes by a Boulé dam with crest at 412.004, which work is already provided for and under way, and by the construction of the sections of dam recommended by the district engineer officer in the project approved by the Chief of Engineers on December 28, 1903, with crests at 412.004 instead of 411.004, recommended therein, this height of crest being desirable for either a 6-foot or a 9-foot slack-water navigation, or even if the river is not further improved by the slack-water method; (4) to remove the rock necessary to complete the widening of the basin at the head of the canal contemplated by the present approved project; (5) to reconstruct the three sections of Boulé dam just north of the head of canal with crest at 415.704, instead of crest at 412.504, as provided for in present project, thus eliminating the cross current across the head of the canal, which current now makes it very difficult for tows to enter the canal at stages between 8 and 12.7 feet. It is proposed to leave the crest of the present fixed concrete dam at 411.004 to serve as a fixed weir for the low-water discharge of the river.

All elevations are in feet above mean tide at Sandy Hook, N. J.

The estimated cost of the work proposed by this Board is as follows:

Widening canal to 170 feet, etc	$673,000
New lock and appurtenances	773,000
New dams	240,000
Reconstructing Boulé dam at head of canal	31,000
Removal of rock in basin	43,000
Total	1,760,000

Of this estimate the act of March 2, 1907, provided for the completion of the third, fourth, and fifth items; in view of which it would appear that former estimates have been superseded or suspended by the latter, which are therefore adopted in this report.

The funds provided by the appropriation of March 2, 1907, are being applied to the removal of rock in the enlargement at the head of the canal, and to the reconstruction of the Boulé dam immediately north of the north wall of the canal, the construction of 500 feet of Boulé dam in Middle Chute, about 1,000 feet of Boulé dam between Middle and Indiana chutes, 648 feet of Chanoine dam in Indiana Chute, and about 600 linear feet of concrete dam between Indiana Chute and the north bank of the river. The height of these sections of the dam is such as will afford a minimum depth of 9 feet upstream to Madison, Ind., and a minimum depth of 6 feet on the lower miter sill at Lock No. 1, Kentucky River.

Following is a brief synopsis of expenditures under the allotments and projects summarized above:

Expended from allotments, 1881, to January 31, 1890		$116,049.80
Expended under project of 1883, for enlargement of head of canal, to January 31, 1890		347,380.68
Reserved, Office Chief of Engineers, United States Army		1,874.20
Expended under project for enlarging canal basin at locks		133,000.00
Expended under revised project of January 31, 1890, to June 30, 1897:		
On enlargement at head of canal	$298,856.35	
On Indiana Chute channel	103,602.81	
		402,459.16
Expended under appropriations for enlargement at head of canal and Indiana Chute, in accordance with project of January 31, 1890, to March 31, 1899		208,659.75
Expended under appropriations for enlargement at head of canal and Indiana Chute, in accordance with the modified project of March 31, 1899 (approved April 8, 1899)		459,075.27
Expended under the project recommended by the Ohio River Board		229,005.95
Total		1,897,504.81

Expenditures during the fiscal year were for work as follows:

Office expenditures and miscellaneous	$4,627.51
Boulé dam, section No. 5	17,616.24
Boulé dam, sections 6, 7, 8, and 9	24,459.16
Chanoine dam, section No. 10	47,786.13
Concrete dam, section No. 11	13,542.54
Removal of rock	18,646.59
Total	126,678.17

The results derived from the expenditures to date for those portions of the work completed have been of marked advantage to traffic and greatly facilitate its movement. The enlargement of the basin immediately above the new locks was completed in 1893 and increased the width of the canal at that locality from 90 feet to 215 feet throughout a distance of 800 feet. At the head of the canal the work of enlargement has been entirely completed from a point 725 feet below the Fourteenth Street Railroad Bridge to a point 2,800 feet above that bridge. Beyond this point, in the basin east of the north canal wall, the excavation to grade within the prescribed limits is about 97 per cent completed, a clear width of 415 feet excavated to grade being at this date available.

In Indiana Chute above Fourteenth Street Bridge the channel width has been increased from 200 feet to 400 feet, and all rock within these limits excavated to the grades prescribed in the project. At Wave rock and Willow Point all excavation and the dikes have been completed. The depth of water over Wave rock and Willow Point approximates very closely the depth anticipated—i. e., 8 feet when there are 8 feet on the upper canal gauge. But that result was not attained for the upper portion of the chute; however, it can now be navigated with ease by heavy-draft coal boats at stages of 11.5 feet, or more, upper canal gauge.

It is proposed to apply the amount recommended as a profitable expenditure in the year ending June 30, 1911, in preparatory work connected with the further items of improvement recommended by the Ohio River Board and not yet appropriated for—i. e., procuring the necessary additional land needed for the enlargement of the canal, preparing data, etc., with a view to advertising the work for contract.

In the money statement of last year's report the "Amount (estimated) required for completion of existing project" was given as $429,215.99, which was merely the balance from the older estimates which have been superseded by that of the Ohio River Board, as hereinbefore mentioned. Therefore it would appear that instead of bringing forward the balance of the old estimates, the balance of that Board's estimate should be substituted therefor, and this has been done in the following statement.

July 1, 1908, balance unexpended	$211, 672. 22
June 30, 1909, amount expended during fiscal year, for works of improvement	126, 678. 17
July 1, 1909, balance unexpended	84, 994. 05
July 1, 1909, outstanding liabilities	1, 744. 82
July 1, 1909, balance available	83, 249. 23
Amount (estimated) required for completion of existing project	1, 446, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	50, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix H H 1.)

2. *Operating and care of Louisville and Portland Canal.*—This canal was constructed by a private corporation, acting under a charter granted by the Kentucky legislature in 1825, and subsequent acts of the same body extending the time for completion and increasing the capital stock. It was completed and the first boat passed through it December 22, 1830. At that time there were three combined lift locks, each with a lift of about 8⅔ feet, a width of 50 feet, and length of 200 feet. The width of the canal proper was from 64 to 68 feet at normal stages, with a depth of nearly 3 feet at extreme low stages of the river. There was no dam at the head of the canal. The United States became a stockholder in the corporation in 1826, and gradually increased its holdings until all of the outstanding stock and bonds passed into its possession.

In 1860 an enlargement and extension of the canal which included new locks was begun under the corporate management, and resulted in the width of the canal being increased to 90 feet, with three basins, or passing places, and the construction of two new combined lift locks with a total lift of about 26 feet. Each of the chambers of the new locks has a width of 80 feet and an available length of 350 feet. The new locks were opened to navigation February 6, 1872.

The United States assumed charge of the work of enlargement of the canal and construction of a dam at the head of the canal subsequent to the allotment of funds for that purpose in 1868, but the operation of the canal and collection of tolls remained under control of the corporate management until June 11, 1874, upon which date the entire control of the canal was assumed by the United States, pursuant to the act of Congress of May 11, 1874, which provided that the canal should be held "free of all tolls and charges, except such as are necessary to pay the current expenses of said canal and keep the same in repair." Tolls were entirely abolished after midnight, July 1, 1880, and since that date the expenses of operation and maintenance of the canal have been borne directly by treasury funds made available by the act of March 3, 1881, and the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

The general project for operation and care of the canal by expenditures under allotments from these acts contemplates the operation of the canal locks, the operation of the dredging plant to keep the canal clear of deposit brought into it by high water, and the repair of existing structures, so as to maintain the whole system in good serviceable condition. The funds are provided under estimates submitted annually at the beginning of each fiscal year and allotments therefor.

The approved project, estimate, and allotment for the fiscal year 1909, in addition to the provisions for ordinary current repairs, supplies, miscellaneous work of maintenance, operation of locks and dredging plant, included items for resetting 625 linear feet of coping on the north wall of the basin at the locks and repaving an area of about 1,742 square yards at that point; also amounts sufficient for the completion of two steel barges and two wooden dump scows. The estimate for the year amounted to $114,027.59, and the funds thereunder made available July 15, 1908.

In reporting the total of expenditures made in connection with this work it seems best, for the purpose of clearness in showing the general application, to subdivide the total to date into amounts for each period indicated, as follows:

From allotments and appropriations, September, 1868, to June 30, 1882, for completion of new locks, enlargement of canal, and for cross dam at head of canal, payment of bonds, etc.	$1,463,200.00
From tolls collected by United States, June 11, 1874, to midnight July 1, 1880, for operation and maintenance	417,069.38
From allotments from act of March 3, 1881, for operation and maintenance	214,062.91
From allotments from act of July 5, 1884, for operation and maintenance	2,133,565.82
Total	4,227,898.11

The amount expended during the past fiscal year is $90,196.94.

The canal is available to commerce at all stages of the river less than 12.7 feet, upper canal gauge, and affords free navigation around the falls of the Ohio River at stages of water when the passage thereover can not be made by the open-river channel.

The zero of the upper gauge corresponds to reference 35 and the bottom of the canal at its head to reference 34, canal datum. The lowest recorded reading of the upper gauge is 1.7 feet; the highest reading on the same gauge is 46.7 feet.

Under the regulations prescribed by the Secretary of War for the use, administration, and navigation of this canal the maximum draft of vessels that can be passed through the canal is limited to the depth of water above zero of the gauge at the time the boat enters the canal.

References to more extended information concerning original condition, purchase, and progress of the improvement of this canal are given on page 491, Annual Report of the Chief of Engineers for 1904.

For a comparative statement of commerce, see the report on this work by district officer.

During the fiscal year ending June 30, 1909, 4,652 boats, barges, and small craft passed through the canal, carrying 963,327¾ tons freight. During the same period 1,308 boats, barges, and small craft passed over the falls via the open-river channel, carrying 360,605½ tons of freight, thus making the aggregate that passed Louisville via both routes 5,960 boats, barges, and small craft, and 1,323,933¼ tons of freight.

(See Appendix H H 2.)

3. *Wabash River, Indiana and Illinois.*—At the time the United States began the work of improving this river it was badly obstructed by bars, accumulations of snags, rocky reefs, and numerous secondary channels or cut-offs, which lessened the flow of water through the main channel. Navigation was impracticable except at high stages of water. A lock and dam has been built at Grand Rapids by the Wabash Navigation Company and a few improvements made at other places, also by private enterprise; but as none of them was of a substantial character, they rapidly deteriorated and became useless.

The original project and outline of improvements proposed is found in the report of Maj. G. Weitzel, Corps of Engineers, January 4, 1872, page 472, Annual Report of the Chief of Engineers for 1872. The first appropriation for work under this project was made by Congress June 10, 1872. This project proposed the improvement of the river from its mouth to Lafayette, Ind., by special works at 12 designated localities, the construction of a new lock and dam at Grand Rapids, and the general work of snagging and dredging. The estimated cost of the work proposed amounted to $312,672.62. Work at various places other than those mentioned in the project has been added from time to time, but no general revision of the original estimate has been made.

The river and harbor act of March 3, 1881, made separate appropriations for work above Vincennes and for work below Vincennes, thus dividing the original project, and subsequent to that date funds have been provided separately for each section.

From the commencement of the work, in 1872, to March 31, 1881, the expenditures, all of which were for work below Vincennes, amounted to $324,845.44. Those for work since that date are given under their respective headings, as follows:

(*a*) *Below Vincennes.*—Subsequent to 1881 work was continued under the original project, but the estimates were modified from time to time as necessity therefor arose, as in the cases for the dam for closing the New Harmony Cut-off, the lock and dam at Grand Rapids, etc. Levee work at Grayville, Ill., was added in 1887, and completed, as proposed, at a cost of $25,000. In 1898 a plan and estimate amounting to $50,000, for additional work at New Harmony was approved, but at the same time it was urged that if the improvement of the river was to be continued the old project should be abrogated, a comprehensive survey of the river made, and a new project formulated, based upon data furnished by the survey and of sufficient scope to meet existing needs of commerce. The survey was authorized and funds therefor provided by the river and harbor act of June 13, 1902. The report on the survey, proposed plan for improvement, estimate of cost, and action taken in connection therewith may be found on page 2729, Annual Report of the Chief of Engineers for 1904. The aggregate of the items of the original estimate applicable to this part of the river and of the several subsequent estimates constituting the estimate of cost of existing project adopted by Congress is $755,000.

The expenditures to March 31, 1881, amounted to $317,845.44, in addition to the $7,000 paid to extinguish the franchise of the Wabash Navigation Company and acquire their property, those for the levee work at Grayville from 1887 to 1892, $25,000, and those for other work since 1881 on this part of the river, $365,111.76, or an aggregate of $714,957.20 for work below Vincennes to June 30, 1909.

Previous to 1885 a fairly good channel for boats having a draft not exceeding 2½ to 3 feet was maintained, but as the river and harbor act of July 5, 1884, made specific appropriation for a lock and dam at Grand Rapids, near Mount Carmel, Ill., the suspension of operations elsewhere became necessary, in view of the fact that the funds available since that date were not sufficient to complete the lock and dam, and at the same time maintain the former works for bank protection and to concentrate the water flow and clear the channel of obstructions. Consequently the work formerly done deteriorated rapidly, the structures being destroyed by ice and high water or rendered useless by the water cutting its way around them. The channels, cut through rock reefs and shoal places, became choked with snags, stumps, and bowlders, thus leaving the river without any permanent improvement excepting that resulting from the lock and dam at Grand Rapids: Through navigation at low water is impracticable. Boats drawing 20 inches can pass from Mount Carmel to Vincennes (a river distance of about 34 miles) at all stages, but can reach Mount Carmel, 92.7 miles from the mouth of the river, only when the gauge at the lock reads 7.5 feet or more.

Commercial statistics will be found in the report for operating and care of lock and dam at Grand Rapids, Wabash River (Appendix H H 4).

References to more extended information are given on page 494, Annual Report of the Chief of Engineers, 1904.

It is not believed that the improvement has had any influence upon freight rates.

There is at present no approved comprehensive project and estimate in force for the improvement of this river, and as a result of a recent preliminary examination none is recommended until the dam in the Ohio River creating the pool in that river at the mouth of the Wabash River shall have been determined upon and completed.

In view of these facts and the further fact that no appropriation for this river has been made since June 13, 1902, and that the small unexpended balance has been covered into the surplus fund of the Treasury, no further report for the sections of river "Above Vincennes" and "Below Vincennes" will be submitted until additional appropriations become available for work on this river.

July 1, 1908, balance unexpended	$42.54
June 30, 1909, amount carried to the surplus fund of the Treasury	42.54

(*b*) *Above Vincennes.*—At the time this section of the river became the object of separate appropriations there had been no revision of the estimate in the original project for the improvement of the river from its mouth to Lafayette. Under the project matured after the appropriation had been made (see Annual Report of the Chief of Engineers for 1881, p. 2001), and subsequent modifications, the estimates to June 30, 1908, amounted to $95,500.

The expenditures on the work of existing project to June 30, 1909, amounted to $95,254.87.

The funds available during the past sixteen years have not been sufficient to maintain the former works for channel rectification and to keep the river clear of snags, bars, and similar obstructions. During the more recent years not enough funds have been available for snagging purposes alone. Therefore it can not be said that any permanent improvement of this section of the river has been effected or that navigation is practicable, except at high stages of water.

The only commercial statistics available are those collected at the lock at Grand Rapids. (See Appendix H H 4.) References to more extended information may be found in the Annual Report of the Chief of Engineers for 1904, page 495.

No further report will be submitted.

July 1, 1908, balance unexpended	$245.13
June 30, 1909, amount carried to the surplus fund of the Treasury	245.13

(See Appendix H H 3.)

4. Operating and care of lock and dam at Grand Rapids, Wabash River.—This lock and dam was built from funds derived from appropriations for improving Wabash River, Indiana and Illinois, and opened to navigation in November, 1893. The available length of the lock is 214 feet; width, 52 feet; depth on lower miter sill at low water, 3.5 feet; depth on upper miter sill at normal pool stage, 5.08 feet. At such stage the pool above the lock affords slack-water navigation about 12 miles, and the maximum draft that can be carried is about 2 feet. Conditions beyond the pool are mentioned in the report for improving Wabash River, Indiana and Illinois.

The expenses of operating the lock were paid from the appropriations for improvement of the river until March 1, 1897, since which date they have been paid from annual allotments from the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

The first and subsequent annual projects proposed the operation of the lock and the maintenance of it and the appurtenant structures in good serviceable condition. The expenditures under these projects to June 30, 1909, amounted to $34,880.06.

The project for the fiscal year 1909 provided for the operation of the lock, ordinary current repairs, and the replacing of old wooden guide and protection cribs, dredging the lock chamber and entrances thereto, and backing the dam, at an estimated cost of $38,218.50, which amount was made available by the allotments of July 17, 1908, and October 7, 1908.

The amount expended during the fiscal year ending June 30, 1909, not including outstanding liabilities, is $2,452.66. A contract for the construction of the new walls, dredging, etc., was entered into

June 2, 1909, but work thereunder had not begun at the close of the fiscal year.

During the past fiscal year 1,494 boats, barges, etc., and 5,121 tons of freight passed the lock.

A comparative statement of traffic and commerce passing the lock during the past twelve years will be found in the report on this work by the district officer.

(See Appendix H H 4.)

5. *White River, Indiana.*—Originally this tributary to Wabash River was badly obstructed by rocky reefs, remains of old structures, and a very great number of snags. It could be navigated only at high stages of water.

The original project is based upon the report of "examination of White River and its forks in Indiana," submitted December 31, 1878. The first appropriation for the improvement was made in the act of March 3, 1879. In this act the work of improvement was limited to "White River, Indiana, from Wabash River to Portersville, and to the falls on the West Fork, according to Report of the Chief of Engineers, without constructing locks and dams." A minimum depth of 2 feet at low water was sought. In 1886 the estimate was reduced. The river and harbor act of August 18, 1894, provided for a resurvey of the river.

Subject to the modifications mentioned, the original project constitutes the existing project of this date. The estimate of cost is $120,000. The amount expended to June 30, 1909, not including outstanding liabilities, is $119,311.58. As a result of these expenditures the lower 13 miles of the river is navigable all the year for boats having a draft not exceeding 3 feet. Above this, to the junction of the two forks, boats drawing 18 inches can navigate for about six months of the year. Low-water navigation on the forks is impracticable even for the smallest boats. This information is derived from the report on the resurvey made in 1895–96, since which date operations have been suspended, the funds available not being sufficient for either work of improvement or maintenance of former structures for controlling the flow of water and bank protection or to keep the channel clear of snags.

No statistics as to the volume or character of commerce moved on this river during the past year are available.

The report upon the resurvey of the river (Annual Report of the Chief of Engineers for 1897, p. 2483) contains data concenring the volume and character of commerce that would be benefited by or involved in the further improvement of the river. This report also contains estimates of cost of improvement under alternative plans and a recommendation that "the further improvement of the White River should be postponed until the improvement of the Wabash has been such as to afford an outlet for any traffic which may then be developed on White River."

References to more extended information concerning this river may be found in Annual Report of the Chief of Engineers for 1904, page 497.

Expenditures during the year amounted to $15.40 and were for mileage on account of an inspection trip made by the district officer.

Work under the old project was completed several years ago, and at present there is no comprehensive project and estimate in force for the improvement of this river. In view of this fact, together with the recommendation contained in the report upon the survey of the river, previously mentioned, and the fact that no appropriation for this river has been made since June 30, 1896, and the balance of that appropriation has been covered into the surplus fund of the Treasury, no further report will be made until additional appropriations become available for work on this river.

July 1, 1908, balance unexpended	$703.82
June 30, 1909, amount expended during fiscal year, for works of improvement.	15.40
June 30, 1909, amount carried to the surplus fund of the Treasury	688.42

(See Appendix H H 5.)

6. Green River, above the mouth of Big Barren River, Kentucky.—Originally this part of Green River was much obstructed by snags, large bowlders, and overhanging trees. Dam No. 4, Green River, afforded slack water for about 18 miles above the confluence of Green and Barren rivers. The fall in that part of the river above slack water and below Mammoth Cave, Ky., a distance of about 29 miles, was approximately 27 feet.

The original project is that submitted under date of August 11, 1891 (printed in Annual Report of the Chief of Engineers for 1891, p. 2481). It proposes the extension of slack-water navigation from the upper limits of pool No. 4 to Mammoth Cave by the construction of two locks and dams at an estimated cost of $361,346.40 for both. No revision of the project and estimate has been made except as provided by the river and harbor act of March 3, 1905, for work of snagging and clearing banks of Nolin River, which will be affected by slack water from Dam No. 6, Green River, for which $5,000 has been appropriated.

The amount expended to June 30, 1909, exclusive of outstanding liabilities on that date, is $365,093.03.

As a result of these expenditures, Locks and Dams Nos. 5 and 6 have been completed and opened to navigation, thus extending slack water to Mammoth Cave, Ky., and through a part of the rich mineral district bordering the river which previously had no conveniently accessible transportation route.

Commercial statistics are given in the report for operating and care of locks and dams on Green and Barren rivers, Kentucky (Appendix H H 7).

References to more extended information may be found in Annual Report of the Chief of Engineers for 1904, page 498.

Report of examination of the river from Lock No. 6 to Munfordville may be found in House Document No. 377, Fifty-ninth Congress, first session.

Sufficient data are not available upon which to determine the effect of the improvement on freight rates, if any.

No work was in progress during the year. The balance available is being held to meet awards in condemnation proceedings which have been instituted for the procurement of land for a roadway from the abutment site to the nearest public highway.

July 1, 1908, balance unexpended	$580.17
July 1, 1909, balance unexpended	580.17

(See Appendix H H 6.)

7. *Operating and care of locks and dams on Green and Barren rivers, Kentucky.*—The original system of slack-water navigation on these rivers, including 4 locks in Green River and 1 lock in Barren River, with a total length of pools of approximately 200 miles, was completed by the State of Kentucky in 1841. The State retained control and management of the system until 1868, when it was leased to the Green and Barren River Navigation Company for a term of thirty years. The act of the Kentucky legislature, approved February 20, 1886, ceded the entire system to the United States upon condition that the unexpired portion of the lease to the navigation company be purchased by the United States. The river and harbor act of August 11, 1888, appropriated $135,000 "for the purchase of the improvements known as the Green and Barren river improvements." The deed from the Green and Barren River Navigation Company relinquising all their rights, privileges, etc., having been duly approved by the Attorney-General of the United States, and the purchase money paid to said company, the Government assumed control of the river, the improvements therein, and the property formerly owned by the State December 11, 1888.

The condition of the improvements and of the rivers at that date was as follows: Lock and Dam No. 1, Green River, required many repairs. The walls of Lock No. 2 were cracked and in bad condition generally, the land wall especially so, it being held in position by anchorage to cribs filled with stone; the river wall had yielded outward. Lock No. 3, Green River, was broken entirely, the river wall having yielded outward and fallen into the river. Lock and Dam No. 4, Green River, was in fairly good condition, with the exception of needed repairs to the quoins and gates. The walls of Lock No. 1, Barren River, were so badly cracked that a part of one of them, the land wall, leaned toward the lock chamber about 6 inches and was liable to fall at any time. The entrances to the locks were obstructed with deposit and the pools with great numbers of snags, overhanging trees, etc.; the appurtenant structures at the locks and the lock tenders' dwellings were in bad condition and inadequate. No snagging or dredging plant was available.

Excepting the funds for rebuilding Lock No. 2, Green River, which were provided by specific appropriations, the funds for the restoration of former structures, the operation of the locks, and maintenance of the system in good navigable condition have been provided by allotments from the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909, under estimates submitted annually at the beginning of each fiscal year. The first project for work on these rivers under the latter act was approved January 4, 1889, and proposed the restoration, so far as practicable, of the former structures to good serviceable condition, the construction of new ones where required, the operation of the locks, the removal of snags, landslides, and deposit from the entrances to the locks, etc., and such has been the general object of each subsequent annual estimate and project.

In addition to the items for the usual work of operation and maintenance, the project and estimate for the fiscal year 1909 provided for new upper gates of steel and new upper miter wall of concrete at Lock No. 1, Green River; renewal with concrete of above-water portions of sections 1, 3, 4, and 5 of the upper river crib, and installing new valves in Lock No. 2, Green River; renewal of above-water portion of upper river crib at Lock No. 3, Green River; new upper gates of steel and new upper miter wall of concrete at Lock No. 4, Green River; completion of repairs to floor, etc., of Lock No. 5, Green River; bank protection at Lock No. 6, Green River; renewal with concrete of lower land crib at Lock No. 1, Barren River, and completion of new hull for snag boat, and various repairs of less important nature to the other structures and floating plant. The estimate for the fiscal year amounted to $138,337.26, which was made available by the allotment of July 15, 1908.

Expenditures during the fiscal year, not including outstanding liabilities June 30, 1909, amounted to $114,195.26.

The aggregate expenditures under the project of January 4, 1889, and subsequent annual projects to June 30, 1909, is $1,484,113.36.

The result of these expenditures is the thorough repair of the several locks of the former system and their appurtenant structures, and the restoration of through navigation in the pools from Lock No. 1, Green River, to Bowling Green, Ky., on Barren River, a distance of 172 miles, for boats not exceeding 35 feet in width, 138 feet in length, and draft not exceeding 5 feet.

At extreme low water in the open river below Lock No. 1, Green River, there is a depth of only 1 foot on the lower miter sill of that lock, which is located 8 miles above the mouth of the river. The system now includes 7 locks and dams, Locks Nos. 5 and 6, Green River, having been built from funds provided by specific appropriations.

Following is a synopsis of traffic and commerce through the locks during the fiscal year:

	Boats.	Freight.
Green River:		*Tons.*
Lock No. 1	4,479	383,581¾
Lock No. 2	2,485	251,671
Lock No. 3	2,674	197,477¼
Lock No. 4	2,661	122,508¾
Lock No. 5	1,487	88,360⅗
Lock No. 6	1,471	46,883
Barren River, Lock No. 1	1,939	30,787½

A comparative statement of the traffic and commerce on these rivers will be found in the report on this work by the district officer.

References to more extended information may be found in Annual Report of the Chief of Engineers for 1904, page 500.

(See Appendix H H 7.)

8. *Operating and care of lock and dam on Rough River, Kentucky.*—This lock and dam was built with funds provided in appropriations

for improving Rough River, Kentucky, and opened to navigation December 12, 1896. The lock has an available length of 123 feet, width of 27 feet, and depth on upper miter sill at normal pool stage of 6.8 feet. At such stage the pool above the lock affords slack-water navigation 21½ miles to a short distance above Hartford, Ky., for boats with draft not exceeding 4 feet.

The expense of operating the lock was paid from the appropriation for improvement until June 30, 1897; since that date the expenses of operating, care, etc., have been borne by the indefinite appropriation for operating and care of canals and other works of navigation, act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909, the funds being made available by allotment for projects and estimates submitted annually at the beginning of each fiscal year.

The project for the fiscal year 1909 proposed to operate the lock and maintain existing structures in good serviceable condition, keep the pools clear of snags, and remove deposits from the lock and approaches thereto, at an estimated cost of $1,508; which amount was made available by allotment July 17, 1908.

Expenditures during the year amounted to $1,328.64, exclusive of outstanding liabilities June 30, 1909.

The amount expended from July 1, 1897, to June 30, 1909, is $10,963.80.

Traffic through the lock during the past fiscal year included 575 boats of various kinds, carrying 21,332½ tons of freight.

A comparative statement of traffic and commerce on this river during the past eighteen years will be found in the report on this work by the district officer.

(See Appendix H H 8.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE DULUTH, MINNESOTA, DISTRICT.

This district was in the charge of Lieut. Col. Graham D. Fitch, Corps of Engineers. Division engineers, Col. W. L. Fisk, Corps of Engineers.

1. *Harbor at Grand Marais, Minn.*—This harbor is an elliptical bay, whose major axis is about one-half mile and whose minor axis is about one-fourth of a mile in length. It has an opening on the south side, which was originally about 1,000 feet in width. Before improvement there was a maximum depth of 14 feet over a very limited area, the general average depth being only 8 or 9 feet. (Depths are referred to mean low water.) It is the only harbor of refuge on the north shore between Agate Bay and the international boundary line, a distance of 125 miles.

The approved project of April, 1879, is to build two breakwater piers, each 350 feet long, from the east and west points of the bay, or one pier 700 feet long from the east point, and dredge an anchorage area of about 26 acres to a depth of at least 16 feet, all at an estimated cost of $139,669.40. For reasons explained in the report of the local officer (Annual Report of the Chief of Engineers for 1898, p. 2217), this estimate was increased to $163,954.63.

Two breakwaters, each 350 feet long, have been constructed from the east and west points of the bay, the work being completed on August 13, 1901.

The amount expended on the project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $166,316.52, of which about $5,379.84 was for maintenance. The work done has resulted in a more protected harbor and a 16-foot anchorage area of about 26 acres.

The expenditures during the year were for incidental expenses and contingencies.

The minimum mean low-water depth over the shoalest part of the locality under improvement is 15 feet.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

The commerce of the port has increased from 25 entrances and clearances, made by 4 tugs and 5 schooners, with 60 tons of cargo, valued at $6,000, in 1878, to 1,250 clearances and entrances, all steamers, with 41,125 tons of cargo, valued at $1,253,574, in 1908.

The value of the commerce of the harbor from 1878 to 1908, both inclusive, is estimated at $10,615,608.

The freight tonnage in 1908 was 15 per cent less than in 1907.

The total expenditures by the Government for this harbor to date are 1½ per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $8,232. This amounts to $0.20 per ton of vessel freight for the year 1908, and to 0.66 per cent of the value of this freight. Further details of these comparisons may be seen in Table 4, Appendix I I 1, of this report.

Effect of project on freight rates: There are no railroads running to this harbor, and the only means of transportation is by water, so that no comparison can be made with railroad charges.

In the original condition of the bay a small commercial business could have been transacted by means of tugs or other vessels of small draft at risk of exposure to storms, and logs could have been rafted to other ports on the lake, also at risk of loss, to be sawed into lumber; but the present commerce of this port could not have been carried on.

The United States improvements have therefore been an indispensable agency in the development of business where none previously existed, and this may be of greater value and importance than a simple reduction of rates.

The available balance and the appropriation recommended will be expended for repairs and maintenance as necessity arises.

For reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 559, where references are given; also page 648 of Annual Report of Chief of Engineers for 1908.

July 1, 1908, balance unexpended	$6,079.02
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	45.54
July 1, 1909, balance unexpended	6,033.48
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I I 1.)

2. *Harbor at Agate Bay, Minnesota.*—This harbor, situated on the north shore of Lake Superior, 27 miles northeast of Duluth, Minn., is an important shipping port for iron ore and lumber and a harbor of refuge.

Before improvement there was ample depth for navigation, with 18 feet or more at mean low water over the greater portion of the harbor, but the harbor was exposed to storms from the southwest and to reverse swells from severe northeast storms.

The approved project of January 4, 1887, was to construct two breakwater piers on a line toward each other from the eastern and western points of the bay, to be 1,000 and 900 feet long, respectively, leaving an opening of 1,340 feet between their extremities and inclosing an area of 109 acres.

In 1899 the total ultimate length of the easterly breakwater was increased by 50 feet.

The original estimate of cost was $213,000, which was increased to $244,208 (see Annual Report of the Chief of Engineers for 1887) on account of higher prices.

The amount expended on the approved project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $250,896.78, of which about $16,839.25 was applied to the maintenance of the improvement.

The amount expended during the year was for incidental expenses and contingencies.

The project was completed on November 1, 1901, and fulfills very effectually the purpose for which it was designed.

The depth at the entrance is over 50 feet, and vessels drawing 20 feet can reach the ore docks in safety.

The usual variation of water level extends from about 0 to about + 1 foot above low-water datum.

The commerce of the port has increased from 174 arrivals and clearances of vessels in 1885, with 263,437 tons of freight, valued at $876,613, to 2,034 arrivals and clearances in 1908, with 6,688,602 tons, valued at $16,941,624.

The total value of the commerce of this port from 1887 to 1908, both years inclusive, is $204,511,992.

The total expenditures by the Government for this harbor to date are one-eighth of 1 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest on cost of improvement, and depreciation, is approximately $14,808. This amounts to $0.002 per ton of the vessel freight for the year 1908 and to 0.87 per cent of the value of this freight, and is one-ninth of 1 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates. Details of these comparisons may be seen in Table 4, Appendix I I 2, of this report.

Effect of project on freight rates: It is estimated that the saving in cost of transportation by water as compared with that by rail for the receipts and shipments of this harbor is approximately $1.94 per ton, which amounts to about $13,000,000 for the year 1908. This is three-fourths of the value of the receipts and shipments for the same year. The government improvements have been an indispensable aid to this commerce. (See the following report for harbor at Duluth, Minn., and Superior, Wis.)

The available balance and the appropriation recommended will be expended for repairs and maintenance.

For reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 561, where references are given.

July 1, 1908, balance unexpended	$5,906.62
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	16.71
July 1, 1909, balance unexpended	5,889.91
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I I 2.)

3. Harbor at Duluth, Minn., and Superior, Wis.—Previous to the Annual Report of 1897 this harbor was reported on under the separate heads of Duluth, Minn., and Superior, Wis., respectively.

The act of June 3, 1896, unified these harbors under the above title and provided for continuous contracts for its improvement to the amount of $3,130,553.

This harbor consists of the Duluth Canal, the Wisconsin Entrance, Superior Bay, Allouez Bay, St. Louis Bay, and St. Louis River to the limits of the cities of Duluth and Superior, about 20 miles from the original natural entry, which before improvement was obstructed by shifting bars with but 9 feet of water over them. The bays were broad expanses of shallow water, averaging only 8 or 9 feet, except along a natural channel through them where the depth was greater, but variable. Depths given in this report are referred to low-water datum, which is a mean low-water level.

The project adopted by the act of March 3, 1881, previous to the present one, was for 16-foot navigation. This was practically completed July 1, 1897, and resulted in giving a good 16-foot navigation through the natural or Wisconsin Entry, through the artificial Duluth Canal, over the Duluth Basin of 104 acres, along and parallel to the principal dock lines of Duluth and Superior in Superior and St. Louis bays, and up the St. Louis River to New Duluth, near the head of navigation of the river, with well-defined channels of from 85 to 300 feet in width.

The amount expended on the project of March 3, 1881, and projects prior to operations under existing project was $1,548,183.

The present project, authorized by the act of June 3, 1896, and by the modifications of August 14, 1896, and May 9, 1901, provided for the widening and deepening to a navigable depth of 20 feet of the existing channels, for new channels in Allouez Bay and St. Louis River, for extensive turning and anchorage basins of a navigable depth of 20 feet at the junctions of two or more channels, for widening the Duluth Canal, and for rebuilding the piers at the Duluth Canal and Wisconsin Entrance and finishing them off with concrete superstructures built of monolithic blocks.

The estimated cost of the work was $3,130,553, but this referred only to the deepening of the channels and basins by dredging. This has been done at much less than the estimated cost, permitting the purchase of lands to the extent of $106,561.19, the rebuilding of the Duluth Canal piers at a cost of over $650,000, including price of land, and leaving a balance of about $275,000 toward the rebuilding of the piers at the Wisconsin Entrance, under construction from 1903 to 1906.

Further modified by project adopted by act of June 13, 1902, at Superior Entry, Wisconsin, with all-concrete construction, increasing the original estimate by $650,000.

The present project has been further modified and enlarged by the act of March 2, 1907, in accordance with the report submitted in House Document No. 82, Fifty-ninth Congress, second session, which provides for excavation of the lake approach to the Duluth entrance to 30 feet for a width of 300 feet, at a cost of $10,000, and the following work at Superior Entry: (a) Building a concrete revetment pier on the north side of entrance, similar to one already built in 1904, on the south side under the project before present modification, these two revetments 500 feet apart and terminating near the lake shore of Wisconsin Point; (b) building two converging breakwaters from the shore out to the 30-foot depth, with an opening of 600 feet on line with the axis of the inner entrance, to be of rubble mound construction, terminating in a crib and concrete pier at outer end and a pile pier at inner end; (c) dredging between the breakwaters to form a channel 600 feet wide and 30 feet deep, and further dredging to form a stilling basin; (d) dredging channel between revetments to a depth of 24 feet; (e) protecting the shore line by riprap; and (f) widening the Superior front channel inside the harbor; estimated to cost $1,703,000. The said act also provided for additional dredging near the draw span of the Northern Pacific Railroad bridge at an estimated cost of $55,500.

The present project has been further modified and enlarged by the act of May 28, 1908, which provides for the expenditure of moneys heretofore appropriated for the harbor for dredging inside the Duluth entrance, in accordance with a report in House Document No. 221, Sixtieth Congress, first session. This report recommended the enlargement by about 209 acres of the anchorage area of the Duluth Basin, by dredging to a depth of 22 feet, low-water datum, an estimated amount of 4,590,000 yards, at a cost of $550,800. These several modifications have a combined estimated cost of $2,319,300, and together with the first estimate of $3,130,553 makes a total estimated cost of $5,449,853 for the present project and its modifications.

The amount expended on the existing project to the close of the fiscal year ending June 30, 1909, exclusive of outstanding liabilities, was $4,392,972.83, of which $466,030 was expended for maintenance.

Operations during the fiscal year ending June 30, 1909, include the following:

The extension of the Duluth Harbor Basin, authorized by act of May 28, 1908, was commenced July 8, 1908, and vigorously prosecuted by the contractors until the close of the season, six dipper dredges being employed at one time. The work was resumed on the opening of navigation in 1909, and is now in progress. The results accomplished to June 30, 1909, are the dredging of 1,716,567 yards at a contract cost of $180,239.54, giving a depth of 22 to 24 feet, extending the area of the basin by 66 acres, and giving a total area in the basin to date of about 237 acres. This is new work. The present contract will be completed before the end of this season, with a total contract cost of about $200,000, which is expected to increase the area to a total of about 245 acres.

Enlargement of East Gate Basin.—Private dredging of sand for dock filling was carried on for a number of years at the easterly side of the East Gate Basin (near the Interstate bridge), under permits from the Secretary of War and the supervision of the district officer. About 850,000 yards of sand were thus removed without cost to the United States, and enlarged the turning basin by about 39 acres, but left an uneven bottom, obstructed by shoals. To render this area available for navigation the shoals have been removed by the United States, between the dates of June 25, 1908, and August 11, 1908. The amount dredged was 99,966 yards, at a contract cost of $11,995.92, and gave a depth of 21 to 25 feet. This is new work, and adds much to the safety of navigation in the approach to the bridge.

Removal of shoals.—Dredging for the removal of shoals from several of the channels of this harbor was commenced June 22, 1909, and at the close of the fiscal year amounted to 43,904 yards, and a contract cost of $5,927.04. This work is expected to be completed in July, 1909, at a total cost of about $20,000, and will give a good navigable depth of more than 20 feet. This work was for the purpose of maintenance.

Superior Entry improvement.—During the fiscal year operations were in progress which nearly completed the north concrete revetment; contract work on the construction of the north rubble mound breakwater was prosecuted; a quantity of riprap was removed from the old channel and placed in the south rubble mound breakwater by United States plant; timber cribs for the seaward ends of the two breakwaters were completed, and will be sunk in place later; a trench has been excavated in the lake for the cribs, some of the bearing piles for these cribs have been driven and cut off; a number of concrete footing blocks have been built to be placed on the cribs; a new steel tug has been completed; and additional plant has been constructed by the United States for use on construction work. The cost of the foregoing operations was $298,447.30, of which $23,467.78 was for administration. The foregoing is new work.

The work done under the existing project up to the close of the past fiscal year has been as follows:

The dredging of channels and basins, which was in operation for six seasons under continuous contract and completed in 1902, removed 21,697,243 yards of material, and gave 17 miles of dredged channels from 120 to 600 feet in width, and basins for anchorage and for turning at the junctions of channels and in the vicinity of bridges of an aggregate area of about 360 acres, all of a depth of 20 feet or more at low water. Since then the lake approach to the Duluth Canal has been deepened to 30 feet or more for a width of 330 feet. The lake approach to the Superior Entry has been deepened to 30 feet or more for a width of 350 feet. Channels have been widened in St. Louis Bay to adapt them to the reconstructed spans of the Northern Pacific bridge, which have recently been enlarged and altered in position.

The East Gate Basin has been enlarged to the extent of 39 acres, as stated elsewhere, giving increased facilities for the passage of vessels through the Duluth-Superior bridge, and for turning from the Rice Point channel to the Superior Front channel.

The Duluth Harbor Basin is being extended in order to provide for much-needed anchorage facilities. The projected amount of such extension, as recommended by the Board, is 209 acres. On June 30, 1909, there had been 66 acres dredged, which is about 31 per cent accomplished of the entire amount. The government harbor line in front of Minnesota Point has been moved inshore to a distance of 750 feet by the Secretary of War in order to provide the room necessary for this extension of the basin.

The maintenance of these channels has been kept up by the removal of shoals, and a maximum draft of 20 feet at mean low water could be carried through any and all of them on June 30, 1909. The usual variation of water level extends from about 0 to +1 foot above low-water datum. The head of navigation is at the foot of the rapids just above the village of Fond du Lac, on the St. Louis River, about 20 miles from Lake Superior.

All the land necessary for the widening of the Duluth Canal has been acquired by deed of gift, purchase, or condemnation, at a cost of $53,919.05.

The land needed for the improvement at the Wisconsin Entrance, the mouth of the Nemadji River, and a marshy island in the St. Louis River, was obtained by condemnation proceedings, at a cost of $42,795.94.

A small parcel of land at the end of Grassy Point and certain lands in Spirit Lake were purchased, at a cost of $3,146.20.

A site for a boat yard on Minnesota Point, near the Duluth Canal, was acquired by purchase and condemnation, at a total cost of $7,200, and the vacation of a portion of a street was effected through the city authorities, which was found necessary in order to carry out a proper system of improvement. This property has now been improved by building a bulkhead and a landing pier, dredging a slip, filling the yard with sand, moving the four government buildings, which had been occupying leased ground at the foot of Seventh avenue, and by fencing in, paving a roadway, and surfacing and seeding for grass. The cost of this improvement has been about $17,750.

New piers were built for the Duluth Canal. These piers have been equipped with 67 iron lamp-posts, and the city furnishes the electric current for lighting the same during the season of passenger travel by lake.

Concrete walls inclosing the government lands at the Duluth Canal were built and the tracts filled to grade, requiring the deposit of about 50,000 cubic yards of material.

The construction of an engineer building on the government land north of the canal for offices and a watchman's house has been completed, at a cost of about $25,000. On May 1, 1906, the rented office rooms were given up and the new building occupied. It is a substantial building, conveniently near the harbor and United States vessel yard, and well adapted to office purposes. The parking of the canal grounds and the construction of additional concrete walls to protect the grounds from flooding by storms have been completed.

At the Wisconsin Entrance (known also as the Superior Entry) the replacing of the old piers by new ones of concrete construction was begun in 1903. About one-half of the south pier was completed in 1904. A description of the method of construction may be seen in Appendix A A A, page 3779, of the Annual Report of the Chief of Engineers for 1904. During the following two years but little was accomplished in the way of construction at the Superior Entry on account of the destruction of protective works by storms. Work on the concrete piers was ordered discontinued by the Chief of Engineers August 21, 1906, pending the consideration of a report by a board of engineers.

Work on the modified project, in accordance with the act of March 2, 1907, was commenced in the spring of 1907, and has been in progress since that time. The results accomplished are stated in detail elsewhere in this report and in the annual reports for previous years. Up to June 30, 1909, about 44 per cent of this projected improvement has been accomplished.

The lake commerce of this port, Duluth-Superior, during the last season of navigation (1908) amounted to 23,797,162 tons (of 2,000 pounds), valued at $223,114,320, and from the beginning of improvements by the Government in 1867 to 1908, inclusive, the vessel freight entering and departing has amounted to 265,979,134 tons (of 2,000 pounds), valued at $3,103,779,620.

It is believed that the tonnage of Duluth-Superior Harbor is now exceeded by that of but two ports in the United States—New York and Philadelphia.

The vessel freight of Duluth-Superior Harbor for 1908 was 57 per cent of the amount which passed the Sault locks the same year.

For a comparison between the cost of improvements and the volume of commerce, it may be stated here that the total amount of money expended by the Government on the improvement of this harbor from the commencement of work in 1867 up to June 30, 1909, is $5,941,155.83. The vessel freight received and shipped at this port during the same period was 265,979,134 tons, and its market value was $3,103,779,620. From this it appears that the cost of government improvements has been less than one-fifth of 1 per cent of the value of the freight transported.

The annual expense of government operations at this harbor, consisting of maintenance, interest on the total cost of improvements to date, and depreciation, is approximately $284,852. This annual expense, when compared with the commerce of the harbor, amounts to about 1 cent for each ton of the vessel freight for the year 1908. Compared with the value of the commerce the annual expense amounts to about one-eighth of 1 per cent of the value of the vessel freight for the same year. For a further comparison it appears that the annual expense is only about one-half of 1 per cent of the saving in cost of transportation by water as compared with rail rates, on the same freight for the year 1908. Further details may be seen in Table 4, Appendix I I 3, of this report.

Effect of project on freight rates: It may not be possible to give exact figures showing the effect of the improvements of this harbor on freight rates, but the following statements have a bearing on the question:

The average rate on freight passing through St. Marys Falls canals in 1908 was 0.69 mill per mile per ton, and the average haul was 842 miles, as shown by the official records. If the same freight had been carried by rail, the rate would probably have been as much as 3 mills per ton-mile, making a difference of 2.3 mills per ton-mile.

Assuming this difference to apply to freight for Duluth-Superior Harbor, and that the average haul is 842 miles, the saving in cost of transportation by water would be $1.94 per ton, and for the 23,797,162 tons received and shipped at this harbor in 1908 the saving in cost amounts to about $46,000,000 in that one year.

The saving in cost of this large sum has, of course, been made possible by the government improvements, not only at this harbor, but at St. Marys River and at other points between here and the Lake Erie ports, and it is not known just how much of the above saving should be credited to the Duluth-Superior improvements. It is evident, however, that with any reasonable proportion of such saving in transportation accredited to the improvements at this harbor, which form an essential and necessary part of the whole waterway, the cost of such improvements must be only a small fraction of the saving in freight rates effected thereby.[a]

The foregoing saving to shippers is based upon a comparison of existing rates of transportation by water and rail. In addition to this it should be said that the rail rates are reduced or kept down by the competition of the waterway, and in that way a further saving in transportation is effected. The two modes of transportation having developed contemporaneously during the last half century, it would be hard to say what the railroad rates would be if the Great Lakes waterway with its government improvements did not exist, but there is hardly room for doubt that they would be materially higher.

The amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, consists of the following items:

(*a*) Dredging to complete anchorage basin at Duluth, Minn., this work being for the extension of benefits	$350,800.00
(*b*) Continuing improvements at the Superior Entry, the work proposed being necessary to make the improvement available, as follows:	
For completion of concrete superstructure to the breakwater heads of north and south rubble mound breakwaters	50,500.00
For completing north and south rubble mound breakwaters	255,530.00
Removal of old timber cribs	19,000.00
Dredging north side of inner channel as shown on sheet 3 (Report of Board of Engineers approved April 5, 1907)	64,368.00
	389,398.00
Administration and contingencies, 20 per cent	77,879.60
	467,277.60
Grand total for improvement	818,077.60
(*c*) For maintenance	25,000.00
Total for improvement and maintenance	843,077.60

---

[a] A similar saving in freight rates applies to other harbors in the Duluth district which have railroad connections and where harbor improvements executed by the Government (or in part at private cost) have opened up these harbors to interlake navigation and commerce. The above-named amount of saving in cost of transportation, $1.94 per ton, will be considered as also applying approximately to the harbors of Agate Bay, Ashland, Ontonagon, Marquette, Marquette Bay, Grand Marais (Mich.), and the local harbors of the Keweenaw waterway, subject to more or less error, according to different local conditions, such as the class of freight, its destination, number of competing railroads, facility of handling freight by boat and by rail, etc. (See Table 4, Appendix I I 3, of this report.)

With regard to the maintenance of improvements in this harbor, it is believed that this could be advantageously provided for by an annual allotment.

With 49 miles of harbor frontage, 17 miles of 20-foot channels, and the handling of over 23,000,000 tons of freight in the past year, there is necessity for the closest inspection, by a special patrol provided with a steam tug, to prevent injurious deposits, encroachments of wharves and other private structures, the enforcement of rules regarding the rafting of logs, the anchorage of vessels, the opening of draws, and the care of United States property. These, with the discovery and removal of shoals, repairs to government piers, the care of parks, and the collection of complete and reliable commercial statistics, which has already proven of great value, it is thought could best be cared for by congressional action authorizing allotments or appropriations to be made on estimates submitted.

For reports of examinations and surveys of Duluth-Superior Harbor, see the Annual Report of the Chief of Engineers for 1906, page 565, where references are given. See also Annual Report for 1907, Appendix J J, page 1833, and Annual Report for 1908, page 648.

July 1, 1908, balance unexpended		$762,735.72
Amount allotted from appropriation by river and harbor act approved March 3, 1909		470,000.00
		1,232,735.72
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$487,488.05	
For maintenance of improvement	40,000.00	
		527,488.05
July 1, 1909, balance unexpended		705,247.67
July 1, 1909, outstanding liabilities		20,984.36
July 1, 1909, balance available		684,263.31
July 1, 1909, amount covered by uncompleted contracts		170,000.00
Amount (estimated) required for completion of existing project		1,043,799.20
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		843,000.00

(See Appendix I I 3.)

4. *Harbor at Port Wing, Wis.*—The harbor of Port Wing, formed by the mouth of Flag River, is situated on the south shore of Lake Superior, about 33 miles from the head of the lake.

Before improvement the depth at entrance was small and variable. It was 2 or 3 feet at times, and at other times the entrance was closed entirely.

Previous to government operations the harbor had been improved by private parties to some extent. The entrance had been jettied, but imperfectly and with only partial success, and dredging was necessary every spring for removing a sand bar. Within the harbor much dredging had been done to accommodate the lumber business.

In accordance with the provisions of the act of Congress approved March 3, 1899, a report upon a survey of this harbor with a project for its improvement was submitted on November 20, 1899.

This project provided for the construction of two parallel piers of piling, filled in with slabs and topped with large rock. These piers were to be located 200 feet apart and to be 800 feet and 825 feet long, respectively. A channel 150 feet wide and 15 feet deep was to be dredged between the piers and for 500 feet along the slough. The estimated cost of the improvement was $44,992, increased in 1908 to $56,539, on account of underestimate for dredging in the original estimate.

By act of Congress approved June 13, 1902, the project was adopted; the village of Port Wing conveyed to the United States without cost 7 acres of land at the harbor entrance needed for the improvement, and the work of improvement was commenced in 1903.

The amount expended on this work to the close of the fiscal year ending June 30, 1909, exclusive of outstanding liabilities, was $46,991.66, of which $5,689.71 was for maintenance.

Operations during the year consisted in dredging for the removal of shoals, between the dates of April 22 and May 3, 1909, 7,015 yards at contract cost of $1,245.16. This partially removed the shoals and opened a narrow passage which would accommodate any vessels wishing to do business there. The dredge then proceeded to the work of removing shoals elsewhere, and later will return and complete the dredging of shoals at Port Wing.

The following results have been accomplished: The two entrance piers built, with lengths of 800 and 601 feet, respectively; 45 feet of pile revetment at the inner end of the east pier; dredging which gave an entrance channel 15 feet deep at low water, 100 feet wide, and extending from deep water in the lake through to a distance of 200 feet inside of the inner end of the east pier; a portion of the turning slip, extending 70 feet to the east, past the inner end of the east pier, with a width of 80 feet and a depth of 14 to 16 feet; a pile revetment 100 feet long at the inner end of the west pier, and maintenance of improvement by dredging of shoals and repairs to the piers.

A maximum draft of 14 feet can be carried June 30, 1909, at mean low water over the shoalest portion under improvement. The usual variation of water level extends from mean low water (low-water datum) to 1 foot above datum. The entrance piers have been effective in reducing shoaling very materially.

Private dredging extended a navigable channel to a distance of about 2,500 feet southerly from the entrance, and this improvement marked the limit of navigation on Flag River. This stretch of river has been redredged from time to time by private enterprise, and the lower portion has an available depth of probably 14 feet for a short distance from the entrance, while the upper portion is now badly shoaled.

The vessel freight of this harbor was 64 arrivals and departures, with 31,127 tons (of 2,000 pounds), valued at $305,000, in 1901, and 288 arrivals and departures, with 23,100 tons (of 2,000 pounds), valued at $312,941, in 1908.

The freight tonnage in 1908 was but 22 per cent of that for the previous year, owing to the general business depression.

The total freight of this port for the six years 1903 to 1908, inclusive, since the date of commencement of government improvements, was 299,294 tons of 2,000 pounds.

The total expenditures by the Government for this harbor to date are only $1\frac{1}{3}$ per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government improvements at this harbor, consisting of maintenance, interest, and depreciation, is approximately $3,426. This amounts to 1 cent per ton of the vesesl freight for 1908, and to $1\frac{1}{10}$ per cent of the value of this freight. Further details may be seen in Table 4, Appendix I I 4, of this report.

Effect of project on freight rates: This harbor has only water transportation for the movement of its freight, and for this reason no comparison can be made with freight charges by railroad.

The construction of a harbor here has been an essential factor in the development of the commerce of Port Wing. There was no commerce to mention previous to these improvements. In 1907 it amounted to nearly a million dollars.

The principal sawmill of this place, which had shut down in June, 1905, as noted in the Annual Report of the Chief of Engineers for 1905, page 1990, resumed operations in the spring of 1907, with a prospect for continuous work for many years. Other timber products and a good brownstone quarry add materially to the vessel business.

A revised estimate gives $15,237 as the amount required for completing the approved project. Details may be seen in the report of the district officer for 1908.

It is proposed to expend the sum recommended to be appropriated for this harbor for the completion of the project, consisting mainly of dredging to give full dimensions of channels, and for maintenance in removing shoals and for repairs to the entrance piers. These expenditures will result in an extension of the benefits to navigation.

A more detailed description of the harbor may be seen in House Document No. 114, Fifty-sixth Congress, first session, and in Bulletin No. 18, Survey of the Northern and Northwestern Lakes, page 75.

For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 568, where references are given.

July 1, 1908, balance unexpended	$0.34
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
July 1, 1909, balance unexpended	5,000.34
July 1, 1909, outstanding liabilities	100.00
July 1, 1909, balance available	4,900.34
July 1, 1909, amount covered by uncompleted contracts	4,400.00
Amount (estimated) required for completion of existing project	15,237.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,237.00

(See Appendix I I 4.)

5. Harbor at Ashland, Wis.—Ashland Harbor is located at the head of Chequamegon Bay, and originally had no protection from the waves which rolled into the bay nor from waves generated within the bay itself by storms.

The natural depth at the entrance, and through the bay up to the vicinity of the present harbor line along a large part of the city front, was at least 19 feet at mean low water, requiring no dredging except for private slips, but for the southwest part of the city front shoaler water is found, which required the dredging of a public channel in front of the harbor line.

The original project, approved December 7, 1888, and modified February 9, 1889, was for the constructing of a pile, slab, and rock breakwater 8,000 feet long, and for dredging a channel in front of the wharves of the city.

The original estimates of cost were, for dredging, $65,540; for breakwater, $165,760.

The act of March 3, 1899, added to this project by authorizing an extension of the breakwater to the shore, thus requiring the ultimate construction of 10,200 feet of breakwater. The emergency river and harbor act of June 6, 1900, provided that the appropriation already made should be expended in building a shore spur 4,700 feet in length from a point 2,600 feet east of the prolongation of the present breakwater and parallel thereto. This again changed the project, adding greatly to the total length of breakwater to be constructed and largely to the total expense.

The total amount expended on this project and its modifications up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, is $456,820.22, of which amount $261,555.06 has been applied to the maintenance of the improvement.

Under this project and its two modifications there have been constructed 7,454 feet of breakwater on the original line and 842 feet on the line fixed by the act of June 6, 1900.

Of the 7,454 feet on the original line 91 feet is detached and uncompleted work near shore and 7,363 feet is completed breakwater in one piece.

The pile, slab, and rock breakwater on the original line is in very poor condition, and has required large expenditures for maintenance.

The work of revetting this structure with riprap so as to form a permanent rubble-mound breakwater, with the old structure for a hearting, was begun in May, 1903, and has continued with more or less work each year up to the present date, under three successive contracts. Under each of these contracts the plant was small and the rate of progress rather slow, but the low prices obtained under competitive bids compensated in a measure for the greater length of time required. A diagram showing the method of reenforcing the breakwater may be seen in the Annual Report of the Chief of Engineers for 1905, page 1992.

Operations for the fiscal year consisted in the continuation of the work of revetment of the breakwater, on the above described plan, from July 1, 1908, to November 18, when the existing contract was completed. The results accomplished during this period was the revetment of a linear distance of 1,623 feet of the breakwater, which required the placing of 43,116 tons of rock, at a contract cost of 99 cents per ton, or $42,684.84. This work is for maintenance.

On June 30, 1909, the total distance revetted was 6,905 feet, which is 94 per cent of the entire length of the present breakwater.

The work done gives a protected area of about 1,600 acres and affords safe anchorage and dockage for a distance of 3 miles along the city front.

The usefulness of the breakwater was in evidence when the northeast storm of September 2–3, 1905, caused considerable damage to the village of Washburn, across the bay from Ashland, breaking in 10 of the doors of the large flour shed of the Northwestern Railway Company and cutting away the embankment of the railroad approach, while the numerous docks along the Ashland Harbor front under the protection of the breakwater escaped injury. This storm seriously damaged the breakwater itself along the portions which had not been strengthened by the rock embankment.

Dredging by the Government in the years 1897, 1903, and 1907 constructed a channel which has a length of 5,760 feet and extends in front of the existing wharves of the city where the original depth of water was not already sufficient for navigation. This channel now has a width of 80 to 120 feet for a depth of 20 feet or more at mean low water and a somewhat greater width for an 18-foot depth. The width is not as great as it should be.

The dredgings from this channel have been deposited alongside the government breakwater to form an earth embankment and lessen the amount of rock required for the revetment.

Easterly from the dredged channel the natural depth of the bay in front of the harbor line is a little more than 19 feet at mean low water and sufficient for the present needs of commerce.

The usual variation of level of the water surface is from about 0 to +1 foot, referred to mean low water.

The commerce of this port carried by vessels consists principally of iron ore and lumber exported, and coal, mineral oil, and general merchandise imported. (With the commerce of Ashland are included the towns of Washburn and Bayfield, unless otherwise stated.)

The commerce has increased during the twenty-two years the harbor has been under improvement by the United States from 892 arrivals and clearances, with cargo tonnage of 1,400,000 tons (of 2,000 pounds), in 1887, to 1,490 arrivals and clearances, with cargo tonnage of 3,658,530 tons (of 2,000 pounds), valued at $17,738,143, in 1908. The total commerce from 1887 to 1908, inclusive, is estimated at 73,607,250 tons (of 2,000 pounds), valued at $526,624,067, exclusive of logs towed in rafts.

The total expenditures by the Government for this harbor to date are only one-eleventh of 1 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of Government improvements at this harbor, consisting of maintenance, interest, and depreciation, is approximately $23,605 and amounts to $0.006 per ton of the vessel freight for 1908 (for Ashland alone), to one-tenth of 1 per cent of the value of this freight, and to one-third of 1 per cent of the saving in the cost of transportation on the same freight, by water as compared with rail rates. Further details of these comparisons may be seen in Table 4, Appendix I I 5, of this report.

Effect of project on freight rates: The estimated saving in cost of transportation by water over that by rail is $1.94 per ton, which is more than $6,000,000, for the business of this port in 1908. (See also page 633 of Annual Report of Chief of Engineers for 1908, and Table 3 of Appendix J J 5.)

The protection to the commerce of Ashland alone afforded by government improvements is fully stated in another part of this report.

The extension of the breakwater for a distance of 637 feet to the west, as required for completion to the projected length of 8,000 feet, has been delayed for some years past in order to strengthen the portion already built. It is now believed that the execution of this extension should be taken up at once. The district officer has submitted an estimate for this extension (see Appendix I I 5), in which the details of the original plan are changed so as to substitute for the original piles and slabs a rubble mound, resting on a fill of earth from dredgings deposited without cost to the United States, the rubble mound to be built of rough quarried stone, and of simple construction, and to be terminated at the west end by a pierhead built of timber, rock, and concrete, for a landing and for a suitable finish to the breakwater, and to provide a base for a light-house and fog signal. The cost of this extension is estimated at $50,172. The original estimate, for the pile and slab construction, was $25,811, but at current prices this would be increased to $64,974, so that the proposed modification in detail is a desirable one on account of both permanency and economy. It has accordingly been adopted by this office.

The amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, will be applied as follows:

For improvement to widen channel to 200 feet	$25,000
For extending breakwater 637 feet (in part)	35,000
Total for improvement	60,000
For maintenance and contingencies (in addition to unexpended balance)	5,000

The additional work proposed is for the purpose of extension of benefits to navigation and commerce. Additional details regarding the work proposed may be seen in Appendix I I 5.

References: Map in Annual Report of the Chief of Engineers for 1903, page 1812. Lake Survey chart of the Apostle Islands, including Chequamegon Bay, catalogue No. 962. Lake Survey Bulletin No. 18, page 41. For reports on examinations and surveys, see Annual Report of Chief of Engineers for 1906, page 570, where references are given.

The river and harbor act of March 3, 1909, authorized a preliminary examination of "Ashland Harbor, with a view to widening the channel to four hundred feet, or to such width as may be deemed suitable for the needs of commerce." Report thereon will be submitted to Congress at its next session.

July 1, 1908, balance unexpended	$64,412.84
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	89,412.84
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	56,733.06
July 1, 1909, balance unexpended	32,679.78

July 1, 1909, amount covered by uncompleted contracts	$25,000.00
Amount (estimated) required for completion of existing project	311,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	65,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I I 5.)

6. *Harbor at Ontonagon, Mich.*—The entrance to Ontonagon River, which forms the harbor, had but 6 or 7 feet depth[a] in 1867, at which time the project for securing 12 feet depth by building parallel piers on either side of the mouth, extending to the 18-foot curve of depth in Lake Superior, and dredging a channel between the piers, was adopted. Estimated cost, $363,770. The west pier was built to a length of 2,675 feet and the east pier to a length of 2,315 feet. This brought the outer end of the west pier very nearly to the 18-foot curve of depth, as proposed.

As far as new work is concerned the project has been completed since 1889, and since then expenditures have been only for keeping a 12-foot channel open by dredging and for the repairs to the piers.

The amount expended on this improvement up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, is $378,279.26, of which sum $93,478.02 has been spent for maintenance of the improvements.

Operations during the last fiscal year were for maintenance, by the dredging of shoals from the entrance. This dredging was done in May and June, 1909, to the extent of 39,257 yards, at a contract cost of $7,027. Work not completed at date of this report. This dredging has made a narrow channel through the bars which had formed, giving a depth of 15 feet or more for a width of 40 to 50 feet, from the lake and through the piers and up to the north end of the lumber dock on the west side of the harbor. About 13 feet is the available depth up to the north end of the Commercial Dock, on the east side of the harbor.

The amount of dredging done from year to year since the completion of the project for maintaining a 12-foot depth through the entrance is shown in tabular form in Appendix I I 6. From this it will be seen that the amount of shoaling previous to 1905 was generally small, but that for the last five years it has been abnormally great. The cause of this recent shoaling is not fully understood, but a discussion of the subject may be seen in House Document 444, Sixtieth Congress, first session, pages 3–5. The floods which bring down the sediment do not occur every year, as a rule, but provision should be made for relieving the situation when they do occur.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

In 1867 there were 449 arrivals and departures, with 5,000 tons of cargo, and in 1908 there were 366 arrivals and departures, with 13,049 tons (of 2,000 pounds) of cargo, valued at $254,022.

---

[a] The datum plane for these depths is not known.

The commerce of this port since the commencement of operations by the United States is estimated at 2,808,052 tons (of 2,000 pounds), valued at $75,365,517.

The amount of freight received and shipped in 1908 was greater by 78 per cent than in 1907, but in value of freight it was 26 per cent less than in 1907.

The total expenditures by the Government for this harbor to date are one-half of 1 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $19,314. This amounts to $1.48 per ton of vessel freight for the year 1908, to 7.6 per cent of the value of this freight, and is 76 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates. Details of these comparisons may be seen in Table 4, Appendix I I 6.

Effect of project on freight rates: The estimated saving in cost of transportation by water over that by rail is $1.94 per ton, or $25,315 for the lake commerce of this port in 1908. As the former condition of the river was unsuited to navigation, this saving in freight rates may be considered as effected by United States improvements.

The amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, will be applied as follows: For maintenance, consisting of dredging for the removal of shoals, repairs to piers, and administration, $10,000.

The work proposed is for the purpose of making the improvements available and for extension of benefits to navigation and commerce.

References: For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 571, where references are given; also page 647 of Annual Report for 1908.

The river and harbor act of March 3, 1909, authorized a preliminary examination of Ontonagon Harbor. The questions under consideration are (*a*) whether the project should be modified so as to provide for deeper dredging of the entrance channel, and (*b*) how far to extend the government dredging within the inner harbor. Report thereon will be submitted to Congress at its next session.

July 1, 1908, balance unexpended	$831.76
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	20,831.76
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	983.02
July 1, 1909, balance unexpended	19,848.74
July 1, 1909, amount covered by uncompleted contracts	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I I 6.)

7. *Waterway across Keweenaw Point, from Keweenaw Bay to Lake Superior, Michigan.*—This work was formerly reported on as

the Portage Lake and Lake Superior canals, across Keweenaw Point, Michigan.

In accordance with the provisions of the river and harbor act of September 19, 1890, the United States purchased and assumed the charge and care of these canals on August 3, 1891.

At the time of the purchase by the United States there was a very poor 13-foot navigation;[a] the channel was narrow and crooked, with many sharp bends; it was poorly marked and lighted; the entrance piers were in a very bad condition; the revetments were decayed or entirely gone, and there was a tax on the commerce through the canals in the shape of a tonnage charge.

The original project, adopted January 24, 1887, was—

1. For a 16-foot channel of 70 feet bottom width from bay to lake.
2. A renewal of the canal revetments.
3. A reconstruction of the piers at the Lake Superior entrance and their extension to 30 feet depth of water.
4. The extension of the pier at the Keweenaw entrance to a 20-foot depth of water.
5. At the proper time to increase the channel depth to 20 feet, with a corresponding width, which should not be less than 120 feet.

The sum expended in the purchase of the canals, lands, etc., and on items 1 and 2 of the original project was $850,000.

The act of June 3, 1896, authorized continuing contracts to complete items 1, 2, 3, and 4 of the above project to the amount of $1,115,000.

By modification approved March 15, 1898, the width and depth were to be increased to 120 feet and 20 feet, respectively, as originally contemplated.

The total amount expended on the original project and its modifications up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $1,338,431.39, of which about $39,000 was expended for maintenance.

The entire project, including the modification for 20-foot depth and 120-foot width, was completed at a cost of only $45,000 in excess of the estimate for the 16-foot depth, or $715,000 less than the estimated cost of the larger project.

The expenditures during the year were in payment of dredging done in June, 1908.

As a result of government improvements (together with the earlier private improvements) this waterway has a clear width of 120 feet and a clear depth of 20 feet at low water datum (mean low water) throughout its entire length, and with a greater width on bends in the channel.

The available balance of the appropriation for improvement was intended for renewal of the old revetments, but it is believed that those remaining may not need renewal, and the money will be held until the necessity shall be demonstrated.

The maximum draft that can be carried June 30, 1909, through the waterway is 20 feet at mean low water.

The usual variation of water level extends from about 0 to + 1 foot, referred to low-water datum.

---

[a] The plane of reference for this depth is not known.

Certain important additional improvements have been recommended for this waterway, as follows:

A harbor of refuge near the lower or easterly end of the waterway, somewhat similar to the one known as Lily Pond at the upper or westerly end, where vessels can find facilities for mooring and lying in safety during heavy weather. A preliminary examination, together with surveys, plans, and estimates, had been duly authorized and reported. The report was printed in House Document No. 325, Sixtieth Congress, first session, and attention is invited to same.

An improvement to the upper entrance to the waterway has been recommended by the district officer and concurred in by the division engineer, namely, to deepen the stilling basin—that is, the protected area just within the breakwaters—by dredging out the shoal portions to a minimum depth of 22 feet within a radius of about 1,700 feet from the outer opening between the breakwater ends and removing the outer portions of the old timber revetment piers, which are located at the entrance from the stilling basin to the canal proper, to within 200 or 300 feet of the shore line and about 1,700 feet from the outer opening from the lake. This would give more room for vessels, which is much needed in making the entrance during heavy winds in order to right themselves after passing the outer entrance and head for the channel between the revetment piers.

At present the distance from the outer entrance to the channel is so small (about 1,280 feet) and the deep water in the stilling basin is so narrow that vessels experience trouble in making the inner entrance during storms. Since the completion of the breakwaters in 1902 nine vessels have gone on the bottom within the outer entrance on that account, and five of these vessels required assistance from the life-saving crew. The proposed improvement would be of great value to navigation, and is worthy of careful consideration.

During the navigation season of 1908 the commerce through the waterway amounted to 959,738 short tons of freight, valued at $45,072,212. There were also 10,229 passengers carried.

This commerce is the through commerce of the waterway only. The local commerce, or commerce between ports within the waterway and points outside, amounted to 1,304,176 short tons, valued at $32,251,686. Previous to 1907 the through and local commerce was combined, therefore no comparison is made of the commerce of 1908 with previous years.

There was also a small local business between the ports on the waterway (Houghton, Hancock, Dollar Bay, Lake Linden, Hubbell, and Chassell) not included in the foregoing, the amount of which is not known.

Effect of project on freight rates: Based on the above commerce, the estimated saving of $1.94 per ton in freight rates by water over railroad rates amounts to two and one-half millions of dollars. This business would not be possible except for the improvements to this waterway, which the Government has either executed itself or paid for by purchase.

This waterway also serves a useful purpose as a harbor of refuge, and is much used by vessels bound up or down doing business at the head of the lake, particularly during the stormy season in the fall of the year. As many as 46 vessels have been tied up at one time at Lily Pond waiting for weather. By lessening the danger and risks of navigation in this manner, to whatever degree, makes this waterway to that extent a factor in the reduction of cost of transportation.

For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 574, where references are given; also House Document No. 325, Sixtieth Congress, first session.

July 1, 1908, balance unexpended	$4,543.18
June 30, 1909, amount expended during fiscal year, for works of improvement	2,736.89
July 1, 1909, balance unexpended	1,806.29

(See Appendix I I 7.)

8. *Operating and care of waterway across Keweenaw Point from Keweenaw Bay to Lake Superior, Michigan.*—During the fiscal year ending June 30, 1909, the sum of $12,000 from the permanent indefinite appropriation of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909, was expended in repairs to the breakwaters, in dredging, in superintendence and general operation of the canals, guarding against encroachments on the channels by private parties and corporations, on surveys and mapping of the waterway, the collection of commercial statistics, the cutting of trees from government lands adjoining the waterway which had been burnt over in the season of 1908, and of additional green timber, to the number of 1,804 logs altogether, of hemlock and other timber, the sawing of these logs into timber, planks, and lumber, amounting to a total of 162,618 feet b. m., for use in repairs to government works on the waterway, etc.

An allotment of $16,000 from the same source for the same purpose has been made for the fiscal year ending June 30, 1910.

To June 30, 1909, $194,207.64 had been expended on this work.

For further details see report on this work by the district officer.

(See Appendix I I 7.)

9. *Harbor at Marquette, Mich.*—This harbor, which had a natural depth of 18 feet or more at mean low water, afforded no protection to vessels from easterly or northeasterly storms, and projects were approved in 1867 and 1887 for the construction of a breakwater composed of cribs filled with rock and projecting from the shore into the bay a distance of 3,000 feet. This breakwater was finished in 1894 practically as projected, but since its commencement extensive repairs have been made to the superstructure.

The amount expended up to the commencement of operations upon the new project was $469,732.44.

A project for a concrete superstructure was approved February 27, 1890. Its estimated cost was $232,936.71.

Work on this concrete superstructure was begun in the spring of 1895, and it is now built to a length of 2,920 feet, which is 97 per cent of the entire length. It is 100 feet short of the end of the old breakwater, and all that remains to complete the existing project is to build a pierhead and connect it with the finished work.

The amount expended on the new project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $200,111.85, of which $19,769.83 was spent for maintenance.

The expenditure during the year was for incidental expenses and contingencies.

The work done has resulted in the protection of the ore, coal, lumber, and commercial docks from storms, and has shown the efficiency of the concrete breakwater.

A preliminary examination and a survey of Marquette Harbor and vicinity, "with a view to ascertaining whether further harbor of refuge facilities are needed, and if so, at what point," authorized by the river and harbor act approved June 13, 1902, were made by the district officers, who express the opinion that greater refuge facilities are needed in this vicinity; that Marquette Harbor is the best place for such improvement; and that the additional shelter should be secured by extending the present breakwater for a distance of 1,500 feet, at an estimated cost of $303,000. The reports on this subject were transmitted to Congress by the Secretary of War December 16, 1903, and printed in House Document No. 161, Fifty-eighth Congress, second session. They are also printed in the Annual Report of the Chief of Engineers for 1904, Appendix I I, page 2786. The document is accompanied by a map of the harbor.

If provision be made by Congress for this extension, no pierhead will be required at the present end of the breakwater, but before beginning the extension the regular form of concrete superstructure would have to be continued over the gap of 100 feet which now remains. This would cost $6,000, and the money could be taken from the funds now held in reserve for further improvement ($21,391) awaiting the decision of Congress on this matter.

Between the breakwater and the ore docks to the west there is generally from 20 to 30 feet of water, except at the northerly 400 feet of the harbor, where the depth at low-water datum is only 14 to 18 feet. This shallow water makes it difficult for vessels doing business at the ore docks at the north end of the harbor, besides somewhat restricting the area available for harbor of refuge purposes, and at least a portion of this area should be dredged to a clear depth of 21 feet at low-water datum.

For the maintenance of the breakwater the sum of $10,000 should be appropriated biennially.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

The vessel commerce of this port was 780 arrivals and clearances during the fiscal year ending June 30, 1872, with a registered tonnage of 370,000 tons, and 316 arrivals and clearances in 1908, carrying 904,979 short tons, valued at $5,039,917.

The total commerce from 1867 to 1908, inclusive, is estimated at 25,001,977 short tons, valued at $139,494,336.

The total expenditures by the Government for this harbor to date are one-half of 1 per cent of the value of the vessel freight received and shipped during the period covered by those expenditures.

The commerce of the neighboring harbor of Marquette Bay, 3 miles distant, is also benefited by the improvements at Marquette, as vessels working at Marquette Bay have to run to Marquette for protection in time of severe storms.

The combined commerce of the two ports thus benefited consisted of 601 arrivals and clearances in the calendar year 1908, with 1,644,088 net registered tonnage, and 2,000,222 tons of freight received and shipped, valued at $7,697,898.

The total commerce of these two ports from the commencement of government improvements in 1867 to 1908, inclusive, is estimated at 43,169,572 short tons, valued at $187,592,411.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $37,775. This amounts to $0.04 per ton of vessel freight of Marquette for the year 1908, to three-fourths of 1 per cent of the value of this freight, and is nearly 2 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates. Details of these comparisons may be seen in Table 4 of Appendix I I 8, of this report.

Effect of project on freight rates: Taking the estimated saving in cost of transportation by water over that by rail as $1.94 per ton, as per Table 4 of this report, and the amount of vessel freight in 1908 as 1,027,715 tons (exclusive of the business done at Presque Isle), makes a total saving of about $2,000,000 for the one year. This may be said to have been affected by government improvements, as lake commerce could not otherwise be transacted at that locality.

It is proposed to expend the appropriation recommended and the available balance (except $21,391 held in reserye for further improvement) for maintenance.

For reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 576, where references are given.

The river and harbor act of March 3, 1909, authorized a preliminary examination of Marquette Harbor, and report will be submitted to Congress at its next session. This investigation was called for with a view to determining the advisability of changing the direction of the extension of the breakwater recommended under the act of 1902, but not yet appropriated for, and removing some shoal areas by dredging.

July 1, 1908, balance unexpended	$28,306.18
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	561.78
July 1, 1909, balance unexpended	27,744.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I I 8.)

10. Harbor of refuge, Marquette Bay, Michigan.—Marquette Bay, also known as Presque Isle Harbor, is a small bay within the city limits of Marquette, north of Marquette Harbor, and distant 3 miles therefrom.

The bay is about 1½ miles long and extends into the shore about one-half mile. The natural depth over the greater part of this area was from 18 to 20 feet at low water, and dredging by the United States has not been considered necessary.

Before improvement the locality was fully exposed to storms from the east and northeast, and comparatively little shipping was done.

A resolution of Congress, approved March 20, 1896, directed the Secretary of War to make a survey and submit an estimate for a breakwater in this bay. The results of this survey, with estimates amounting to $20,000 for breakwater 500 feet long and $50,000 for construction of one 1,000 feet long, are published in House Document No. 318, Fifty-fourth Congress, first session.

The project adopted by the act of June 3, 1896, is to build a breakwater 1,000 feet in length off Presque Isle Point.

This breakwater was built to its full length in the years 1897–1900.

The act of Congress approved June 13, 1902, provided that a portion of the appropriation for Marquette Harbor "not exceeding seven thousand five hundred dollars may be expended in connecting the Presque Isle breakwater with the shore."

Under this provision the gap between the breakwater and shore was closed, in the fall of 1902, by a timber pier 216 feet long and 100 linear feet of shore revetment constructed.

No additional work is proposed except for maintenance.

The total amount expended on the project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $57,758.16, of which $2,701.82 was expended for maintenance. The expenditures during the year were for contingencies.

The work done has enabled vessels to lie at the ore pier and other docks in the vicinity in ordinary weather and moderate storms, and shipping has increased greatly.

This harbor is largely used for commercial purposes, but not as a harbor of refuge.

Vessels drawing 19 feet can reach the ore pier at mean low water.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

The lake commerce of this port in 1897 amounted to 1,100 arrivals and departures, with 1,095,243 tons of freight. In 1908 the lake commerce amounted to 285 arrivals and departures, with 972,507 short tons of freight, valued at $2,657,981.

The total commerce from 1897 to 1908, inclusive, is estimated at 18,167,595 short tons, valued at $48,098,075.

The total expenditures by the Government for this harbor to date are one-eighth of 1 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $3,528. This amounts to $0.004 per ton of vessel freight for the year 1908, to one-third of 1 per cent of the value of this freight, and is less than one-fifth of 1 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates. (See Table 4, Appendix I I 10, of this report.)

Effect of project on freight rates: The saving in cost of transportation by water of 1908 freight over the cost by rail, at the estimated figure of $1.94 per ton, as in Table 4 of this report, amounts to $1,886,664. This was made practicable by the government breakwater at this locality. This harbor, as already stated, is not used for purposes of refuge, and it may be questioned whether its freight business could not have been transacted at Marquette, only 3 miles distant, where the Government had already constructed a harbor.

It is proposed to expend the available balance, together with the appropriation recommended, on repairs to the breakwater.

For reference to reports on survey, see Annual Report of the Chief of Engineers for 1896, page 307.

July 1, 1908, balance unexpended	$902.66
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	160.82
July 1, 1909, balance unexpended	741.84
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix I I 9.)

11. Harbor of refuge at Grand Marais, Mich.—Originally the entrance to this harbor was obstructed by a bar having but 9 feet depth of water upon it at low water. The project for its improvement, adopted August 5, 1881, and modified December 21, 1894, has for its object a deep and safe channel into the harbor, making it a harbor of refuge. This object is to be attained by building parallel piers 500 feet apart, projecting into the lake to a depth of 22 feet, and dredging out an 18-foot channel between them, connecting the deep water of the lake with that of the harbor, and by closing up the natural entrance, 5,770 feet in width, by a solid pile dike, driven with a slope toward the waves and strongly braced. The proposed length of each pier was 1,800 feet. The estimated cost of the entire project was $484,000. The west pier has now reached a length of 1,912 feet, the east pier 1,545 feet, and the pile dike is completed.

This dike was built in 1895–1897 to close the natural entrance, to protect the harbor from storms, and prevent the movement of sand into the harbor. The expected formation of a sand beach along the line of the dike is partially realized, but much of the dike is still exposed to the heavy seas and to damage by ice.

The amount expended on the project up to the close of the fiscal year ending June 30, 1909, not including outstanding liabilities, was $468,979.73, of which $113,094.44 was expended for maintenance.

About 3,600 feet of the pile dike was repaired and strengthened between September 1, 1904, and August 6, 1906, under two contracts, at a total cost (including administration) of nearly $54,000.

It is hoped that no further work than this will be necessary on the dike, but it is possible that the riprap will settle into the sand bottom by the action of waves and require additional rock.

Dredging was done in July and August, 1908, for removing shoals from the entrance channel, to the amount of 93,933 yards, at 18¾ cents, or $17,612, which gave a depth of 18 to 21 feet at mean low water and a width of 200 to 300 feet. Repairs to the entrance piers were made in May and June, 1909, at a cost of $484.49, and some extensions to the sand fences west of the entrance were made at nominal cost. (Details in Appendix I I 10, of this report.)

The usual variation of water level extends from 0 to + 1 foot above low-water datum.

In front of the entrance to the harbor the 22-foot curve of depth has advanced lakeward between 500 and 600 feet since the project for improvement was adopted, and this fact will entail some additional expense for pier extension to deep water. • This would now require an addition of 450 feet to the west pier and 794 feet to the east pier. This would bring the total cost of these extensions up to $149,280—about $103,879 more than the original estimate. It is hoped, however, that the original estimate will finish the west pier. This would stop the movement of sand from the west into the channel, and it is possible that the extension of the east pier would not then be necessary.

The commerce of this port has increased from 1,910 tons in 1887 to 1,769 arrivals and clearances, with 54,525 short tons of freight, valued at $2,539,780, in 1907. In 1908 there were 874 arrivals and clearances, with 45,006 short tons, valued at $1,319,658, showing a decrease of 17 per cent in freight and 48 per cent in valuation from 1907.

The total commerce from 1880 to 1908, inclusive, is estimated at 1,435,790 short tons, valued at $24,357,304.

The total expenditures by the Government for this harbor to date are nearly 2 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

The annual expense of government operations at this harbor, consisting of maintenance, interest, and depreciation, is approximately $25,253. This amounts to $0.56 per ton of vessel freight for the year 1908, also to about 2 per cent of the value of this freight, and is about 29 per cent of the saving in the cost of transportation on this freight by water as compared with rail rates. (Details of these comparisons may be seen in Table 4, Appendix I I 10, of this report.)

Effect of project on freight rates: Estimated saving by water transportation as against rail, $1.94 per ton, amounting to $87,312 for the lake commerce of 1908. With the original condition of the harbor this shipping could not have been carried on, and the above-mentioned saving in cost of transportation is a result of the project for improvement.

It is proposed to expend $8,599 of the available balance, together with the sum recommended for works of improvement ($45,401.68), making[a] $54,000, in building the west pier of the entrance out to the 22-foot depth of water, a distance of 450 feet. The remainder of the available balance, together with the sum of $40,000 estimated for maintenance of improvement, will be expended for repairs to piers and the dike and for dredging, as occasion requires.

For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 579, where references are given.

July 1, 1908, balance unexpended	$36,890.96
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	20,147.37
July 1, 1909, balance unexpended	16,743.59
Amount (estimated) required for completion of existing project	45,401.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a] 85,400.00

---

[a] Since the preparation of this estimate, further consideration of existing conditions leads to the conclusion that possibly the project depth of 18 feet may be as efficiently and more economically maintained by dredging alone than by further extension of the piers. Hence, it is believed that this estimate may be reduced to $40,000 for maintenance only, leaving the question of extending the piers to be determined after further experience.

(See Appendix I I 10.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—The steamer *Alex Nimick*, wrecked September 21, 1907, on the south shore of Lake Superior, proving an obstruction to navigation, its removal was authorized.

Contract was entered into June 20, 1908, for this work, which was carried on during the whole season until October 28, 1908, when a severe storm destroyed the contractor's plant. Operations then stopped and were to be resumed in the spring of 1909, as soon as weather conditions would permit. At the end of June the contractor was still awaiting the arrival of his working plant. Parts of the wreck still remain above the 20-foot depth.

The sum of $600 was allotted for this work, of which $50.86 were expended to June 30, 1909, for inspection and contingencies.

The amount of the contract liability is $500, leaving $49.14 balance unexpended July 1, 1909.

The steamer *Sevona* ran on a rocky shoal near Sand Island light, Lake Superior, September 1 and 2, 1905, and became a total wreck.

The owners removed a large portion of the wreck, but it was afterwards found that portions had only 11 feet of water over it, making it an obstruction to navigation. Its removal so as to increase the available depth of water over it for small craft was authorized.

The sum of $1,500 was allotted for the purpose. On June 28 the U. S. steamer *Vidette*, with United States labor and material, left for the work, which was in progress at the close of the fiscal year.

(See Appendix I I 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE MILWAUKEE, WISCONSIN, DISTRICT.

This district was in the charge of the following officers of the Corps of Engineers: Maj. W. V. Judson to March 17, 1909; in the temporary charge of Maj. Thos. H. Rees from March 17 to April 5, 1909; and in the charge of Maj. C. S. Bromwell since the latter date. Division engineer, Col. W. L. Fisk, Corps of Engineers.

General statement with reference to datum plane at all harbors on western shore of Lake Michigan.—The plane of reference or datum plane to which all depths hereinafter stated are referred is a plane 581.63 feet above mean tide at New York City, or the mean level of Lake Michigan for the years 1860–1875.

1. Manistique Harbor, Michigan.—The original depth at the mouth of the Manistique River was 8 feet. By private enterprise 3,000 linear feet of slab piers had been built and a channel dredged to a depth of 11 feet before any appropriation was made by the Government.

The original project, adopted in 1880, provided for increasing the depth of the channel to 13 feet below datum for a width of 150 feet by dredging. The amount expended on this project was $3,955.05.

The present project was adopted by the river and harbor act of March 3, 1905, and provided for pier construction, breakwater extension, and dredging to a depth of 19 feet below datum; estimated cost, $270,000 (see Annual Report of the Chief of Engineers for 1905, p. 525).

In accordance with a provision in the river and harbor act of March 2, 1907, a modification of this project was approved by the Secretary of War April 3, 1908. The modification consists mainly in swinging the inner end of the proposed west pier to the westward, thereby providing a stilling basin, and in extending the east breakwater about

90 feet farther westward than at first provided; estimated cost, $338,462.

Neither of the foregoing estimates includes the acquisition of land and existing structures required in connection with the proposed work, which have been transferred to the United States without expense.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $7,761.80, none of which was applied to maintenance.

The expenditures during the fiscal year have been for dredging, pier removal, crib construction, and general supervision in furtherance of the existing project.

About 2 per cent of the approved project has been accomplished. No practical result in the way of increased depth or width has been obtained as yet. The maximum draft that could be carried June 30, 1909, was about 15 feet. The usual mean annual variation of level of water surface is about 1 foot.

A dam across the Manistique River, located about 1 mile from the mouth of the harbor, constitutes the head of navigation.

Commercial statistics for 1908.—Arrivals of vessels, 44; shipments and receipts, 54,685 net tons. The approximate valuation of the exports and imports could not be ascertained.

The commerce affected by the project is in lumber, coal, and general merchandise. Car ferries call at this harbor during the entire year. The volume of commerce which will be benefited is considerable. No change in the nature of the commerce has as yet resulted.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore, both locally and for transshipment.

It is proposed to expend the available balance in the construction of revetment at mouth of Manistique River, as provided by the project, and in dredging. It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, to the completion of the project. The additional work is necessary to make the improvement available.

For references to more extended information, and for report on examination and survey, see Annual Report for 1904, Part 3, page 2869.

July 1, 1908, balance unexpended	$46,816.43
June 30, 1909, amount expended during fiscal year, for works of improvement	2,533.28
July 1, 1909, balance unexpended	44,283.15
July 1, 1909, amount covered by uncompleted contracts	42,108.32
Amount (estimated) required for completion of existing project	288,462.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	288,462.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix J J 1.)

2. Gladstone Harbor, Michigan.—The harbor of Gladstone is a natural one, and the main channel is from 24 to 42 feet in depth. The portion of this harbor under improvement was obstructed by shoals.

The original project, which is the existing project, was adopted by act of March 3, 1905, and provides for dredging to a depth of 21 feet below datum of so much of the harbor as lies outside of a line drawn perpendicular to the axis of the ore dock through its outer end. Estimated cost $14,000.

The amount expended on the work up to the close of the fiscal year ending June 30, 1909, was $7,527.76, of which $247.17 was applied to maintenance.

There have been no operations or expenditures during the fiscal year.

The approved project was completed in 1905; since then the expenditures have been for maintenance.

The maximum draft which could be carried June 30, 1909, was about 21 feet. The usual mean annual variation of level of water surface is about 1 foot.

Commercial statistics for 1908: Arrivals of vessels, 317; shipments and receipts, 558,098 net tons. The approximate value of exports and imports could not be ascertained.

The commerce affected by the project is mostly coal, grain, flour, and general merchandise, and is general in character. A large volume of commerce is affected by the project.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore, both locally and for transshipment.

For report on examination and survey, see Annual Report for 1904, Part 3, page 2861.

July 1, 1908, balance unexpended	$6,472.24
July 1, 1909, balance unexpended	6,472.24

(See Appendix J J 2.)

3. *Menominee Harbor and River, Michigan and Wisconsin.*—Prior to act of June 13, 1902, the harbor and river constituted two works. By this act they were consolidated.

(*a*) *Harbor.*—Original depth of channel, about 5 feet; width, 200 feet. The original project, adopted in 1871, provided for two parallel piers, 400 feet apart, extending to the 16-foot contour in Green Bay, and for a channel 15 feet deep between them, modified as follows: 1874, extending piers to 17-foot contour; 1890, increasing depth to 17 feet; 1899, increasing depth to 20 feet. Amount expended on original and modified projects, $234,344.77.

(*b*) *River.*—Original navigable depth, 5 feet. The original project, adopted in 1890, provided for a channel 200 feet wide and 17 feet deep, modified as follows: 1892, width at upper end reduced to 100 feet; 1896, formation of a turning basin 250 feet wide, 600 feet long, 17 feet deep at upper end of channel, and extending channel 425 feet for a width of 75 feet. Amount expended on original and modified projects, $114,414.15.

(*c*) *Harbor and river.*—The existing project, adopted by act of Congress approved June 13, 1902, provides for increasing the depth to 20 feet, at an estimated cost of $60,000. Under a provision of the act of March 3, 1905, the existing project was modified by omitting therefrom the improvement of all that portion of the Menominee River above and to the westward of Ogden Street Bridge.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $55,275.52, of which amount $17,023.83 was applied to maintenance. Of this amount $3,514.17 was derived from miscellaneous sources.

There have been no operations during the fiscal year except taking soundings in the harbor and river. The expenditures during the fiscal year have been for taking soundings, repairs and purchase of plant, and for general supervision.

The existing project, as modified, was completed in 1903. Since then the expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1909, over the shoalest part of the locality under improvement was about 17½ feet. The mean annual variation of level of water surface is about 1 foot.

The Menominee River is navigable for a distance of about 2 miles from its mouth.

Commercial statistics for 1908.—Arrivals of vessels, 693; shipments and receipts, 269,507 net tons. The approximate value of the exports and imports for port of Marinette, Wis., is $2,358,396; that for the port of Menominee, Mich., could not be obtained. The volume of commerce, while large, is not increasing.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber, both locally and for transshipment.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and dredging for restoration of channel.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 519, and 1908, page 669.

July 1, 1908, balance unexpended	$5,944.71
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	9,944.71
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,044.98
July 1, 1909, balance unexpended	7,899.73
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J J 3.)

4. *Oconto Harbor, Wisconsin.*—The original depth at the mouth of the river, about 3 feet, was increased by private enterprise to 4 feet before work was begun by the United States.

The original project, which is the existing project, adopted in 1882, provided for extending the parallel slab piers built by the city of Oconto to the 11-foot contour in Green Bay, and for a channel 100 feet wide and 9 feet deep extending up the Oconto River a distance of about 2 miles, at an estimated cost of $150,000; modified in 1897 by abandoning the upper 3,800 feet of the channel; estimated cost of modified project, $115,610.

The amount expended to June 30, 1909, was $92,730.65, of which $8,161.18 was applied to maintenance.

The expenditures during the fiscal year have been for general supervision.

The 9-foot channel was practically completed in 1899.

The maximum draft that could be carried June 30, 1902, was about 7.5 feet. No soundings have been taken since then. Mean annual variation in level of water surface is about 1 foot. For 1,000 feet above the westerly end of the government improvement the Oconto River has a navigable depth of about 3 feet.

There is practically no commerce by way of the harbor. A 9-foot harbor on Lake Michigan at this time is without value to commerce.

It is believed that the project has no effect in controlling freight rates.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Reports for 1904, page 520, and 1906, page 599.

July 1, 1908, balance unexpended	$3,420.35
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	151.00
June 30, 1909, amount carried to the surplus fund of the Treasury	3,269.35

(See Appendix J J 4.)

5. *Green Bay Harbor, Wisconsin.*—This work consists of two improved channels—first, from the mouth of Fox River northerly to the 21-foot contour in Green Bay; second, Fox River below Depere to the southerly limits of the city of Green Bay. The intervening pool in Fox River, connecting these channels, has a natural depth of from 25 to 40 feet and requires no improvement. The outer channel was originally circuitous and narrow, with an available depth of 11 feet. The original navigable depth of the inner channel was also 11 feet.

The original project for outer channel, adopted in 1866, provided for dredging a channel 200 feet wide, 13 feet deep, and 8,800 feet long, and for revetting about 650 feet of same at Grassy Island, modified as follows: 1872, straightening channel and increasing depth to 14 feet; 1874, depth 15 feet, length 11,600 feet; 1892, depth 17 feet, length 16,500 feet; 1897, increasing width at entrance to 500 feet.

The original project for inner channel, adopted in 1892, provided for dredging a channel 150 feet wide and 13 feet deep, modified as follows: 1896, increasing depth to 17 feet.

These channels were completed by the expenditure of $405,945.18.

The existing project, adopted by Congress by act approved June 13, 1902, provides for increasing the depth of the outer channel to 20 feet, at an estimated cost of $105,600. It also provides for maintenance of existing works.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $125,275.77, of which amount $22,936.05 was applied to maintenance.

The expenditures during the fiscal year have been for dredging for restoration of both outer and inner channels, for taking soundings, and for general supervision.

The approved project was completed in 1903. Since then all expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1909, was about 19 feet in the outer channel and 11½ feet in the inner channel. The mean annual variation in level of water surface is about 1 foot. Connecting with the upper end of the inner channel at Depere, Wis., Fox River is navigable by canals and slack-water navigation to Portage, Wis., a distance of 156 miles.

Commercial statistics for 1908.—Arrivals of vessels, 1,381; shipments and receipts, 659,077 net tons. The approximate value of exports and imports could not be ascertained.

The commerce of Green Bay is large and of a general character.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber, both locally and for transshipment.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in maintenance of channels and existing works.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 521.

July 1, 1908, balance unexpended	$2,688.32
Amount allotted from appropriation by river and harbor act approved March 3, 1909	12,000.00
	14,688.32
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,778.38
July 1, 1909, balance unexpended	9,909.94
July 1, 1909, outstanding liabilities	1,915.00
July 1, 1909, balance available	7,994.94
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J J 5.)

6. Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin, and harbor of refuge connected therewith.—Prior to act of June 13, 1902, the canal and harbor constituted two works. By this act they were consolidated.

(*a*) *Canal.*—In its natural condition Lake Michigan was separated from Sturgeon Bay, an arm of Green Bay, by a neck of land about 1⅜ miles wide, having a maximum elevation above the lake level of about 28 feet. The Sturgeon Bay and Lake Michigan Ship Canal and Harbor Company, from 1872 to 1881, constructed across this neck a canal, without locks or gates, 7,200 feet long, 100 feet wide at water surface, and 14 feet deep, and in continuation of the canal dredged a channel in Sturgeon Bay 6,100 feet long, of about same dimensions as the canal. Of the 14,000 linear feet of canal banks, 8,437 feet was provided with pile revetments. The United States assumed possession of the canal April 25, 1893.

The original project, adopted in 1894, provided for building 6,000 linear feet of revetment, width between new revetments to be 160 feet, for building 2,000 linear feet of fender piling, and for a channel

15 feet deep, modified as follows: 1896, provided for a width of 250 feet between revetments for the westerly 1,000 feet of the canal, and for increasing width between revetments, whenever rebuilt, to 160 feet. The original project as modified was completed during the fiscal year ending June 30, 1903.

(*b*) *Harbor.*—Before the construction of this harbor was undertaken the Lake Michigan entrance to the Sturgeon Bay and Lake Michigan Ship Canal was entirely unprotected from storms from northeast to southwest.

The original project, adopted in 1873, provided for the construction of converging piers 850 feet apart at the shore line, and 250 feet apart at outer end, inclosing an area of about 10 acres, which was to be dredged to the requirements of navigation at that time, modified as follows: 1879, provided for sheet piling the pile piers; 1880, provided for extending each pier 150 feet by detached cribs, thereby increasing width of entrance to 335 feet, and dredging to a depth of 17 feet. The original project as modified was completed in 1884.

The amount expended on the foregoing projects is $354,119.26.

(*c*) *Canal and harbor.*—The existing project, adopted by act of Congress approved June 13, 1902, provides for maintenance and for increasing the depth of channel to 21 feet from Lake Michigan to Sturgeon Bay; estimated cost, $222,000. The river and harbor act approved March 2, 1907, authorizes dredging in the vicinity of Hills Point.

The amount expended on existing project up to the close of the fiscal year ending June 30, 1909, is $254,183.95, of which $19,115.28 was applied to maintenance. Of this amount $12,129.40 was derived from miscellaneous sources.

There have been no operations during the fiscal year except taking soundings. The expenditures during the fiscal year have been for dredging done during June, 1908, for taking soundings, for repairs of plant, and for general supervision.

The maximum draft that could be carried June 30, 1909, between Lake Michigan and Green Bay was about 20 feet. Mean annual variation in level of water surface is about 1 foot. The existing project is completed with the exception of a small amount of dredging at Hills Point. As a result of the expenditures the largest vessels can now pass between Lake Michigan and Green Bay.

Commercial statistics for 1908.—Number of vessels passing through canal, 2,307; tonnage, 1,297,504 net tons. Estimated value of cargoes, $18,261,455.15; decrease in value of cargoes in 1908 as compared with 1907, $2,750,240.85.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber. It is impracticable to estimate the amount of reduction in rates thereby effected.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 523.

July 1, 1908, balance unexpended	$33,577.32
June 30, 1909, amount expended during fiscal year, for works of improvement	2,418.13
July 1, 1909, balance unexpended	31,159.19

(See Appendix J J 6.)

7. *Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.*—Under an allotment from the indefinite appropriation of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909, for operating and care of canals and other works of navigation, there was expended during the fiscal year ending June 30, 1909, $18,496.66.

The amount expended to June 30, 1909, is $298,733.06, including $1,545.91 miscellaneous receipts.

Extensive repairs were made to the revetments. Minor repairs were also made to the buildings and plant pertaining to the canal. The premises in the vicinity of the office and watchhouses were graded and otherwise improved, and the canal operated and cared for in accordance with the approved project.

Navigation through the canal opened April 11, 1908, closed by ice December 15, 1908, and resumed April 14, 1909.

For commercial statistics, see report upon improvement of Sturgeon Bay and Lake Michigan Ship Canal and harbor of refuge connected therewith.

(See Appendix J J 7.)

8. *Algoma Harbor, Wisconsin.*—Previous to the improvement of this harbor the depth of water at the mouth of the Ahnapee (or Wolf) River was only 3 feet and the present harbor was not available for purposes of commerce.

The original project adopted in 1875 provided for the formation of a small artificial harbor, connected with the lake by a channel 100 feet wide and 13 feet deep, by pier construction, dredging, and rock removal, modified as follows: 1884, width of entrance increased to 200 feet by offset in each pier, main and detached piers to be connected by guide piling; March 3, 1899, provided for extending the 13-foot channel, for a width of 50 feet, a distance of 800 feet by rock removal and dredging, at an estimated cost of $19,266. The amount expended on this project and its modifications to June 30, 1908, is $201,681.46, of which $8,687.96 was for maintenance.

The existing project, adopted by Congress by act approved March 2, 1907, provides for the construction of an outer harbor, with a depth of 16 feet of water; estimated cost, $140,000, all of which has been appropriated.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $104,908, of which $12,538.54 was applied to maintenance.

The expenditures during the fiscal year have been for construction of pier and breakwater inclosing the outer harbor, for dredging, for repairs of such portions of the old pier as form part of the existing project, for construction of survey boat, for repairs of plant, and for general supervision.

The existing project has been completed with the exception of a small amount of riprap to be deposited along the breakwater and the pier. A small outer harbor with a depth of 16 feet and an area sufficient to permit of turning a vessel has been provided. It is understood that steamers now call at Algoma regularly. The maximum draft that could be carried June 30, 1909, was about 15 feet. The mean annual variation of water surface is about 1 foot.

Ahnapee River is navigable for a distance of about 2 miles from its mouth for crafts drawing 4 feet, but there are no vessels plying on it.

Commercial statistics for 1908.—Arrivals of vessels, 320; shipments and receipts by all ways of transportation, 165,098 net tons. Approximate value of exports and imports by all ways of transportation, $3,550,000. It is estimated by the mayor of Algoma that about one-fourth of the shipments and receipts were by way of the harbor.

The volume of commerce benefited is small and of a local character. It is believed, however, that the project is having an excellent effect in controlling freight rates, but the present harbor has not been available for a sufficient length of time to estimate the amount of reduction in rates thereby affected.

For reference to more extended information, maps, and report on examination and survey, see Annual Report for 1904, page 524.

July 1, 1908, balance unexpended		$118, 615. 23
Miscellaneous receipts		101. 55
		118, 716. 78
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$70, 984. 69	
For maintenance of improvement	5, 000. 00	
		75, 984. 69
July 1, 1909, balance unexpended		42, 732. 09
July 1, 1909, outstanding liabilities		1, 395. 31
July 1, 1909, balance available		41, 336. 78

(See Appendix J J 8.)

9. *Kewaunee Harbor, Wisconsin.*—The original entrance to the Kewaunee River was not more than 20 feet wide, with a depth of about 3 feet at its shoalest point, and was obstructed by submerged bowlders. The present harbor was therefore not available for purposes of commerce.

The original project for its improvement adopted in 1881, which is the existing project, provided for an artificial entrance channel 15 feet deep, located about 2,000 feet south of the river mouth, protected by two parallel piers 200 feet apart, and extending from the shore to the 19-foot contour in the lake. Estimated cost, $200,000.

The amount expended up to June 30, 1909, was $176,086.34, of which amount $26,086.35 was for maintenance. Of this amount, $462.86 was derived from miscellaneous sources.

The expenditures during the fiscal year have been for dredging for restoration of channel, repairs of plant, and for general supervision.

The present project was completed in 1898 at a cost of about $150,000; since then all expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1909, was about 15½ feet. The mean annual variation in level of water surface is about 1 foot.

Connecting with the westerly end of the improved channel Kewaunee River has a navigable depth of 4 feet for a distance of about 6½ miles, but there is no regular commerce on the river.

Commercial statistics for 1908.—Arrivals of vessels, 447; shipments and receipts, 83,780 net tons. The commerce is quite large in volume and is of a general character. A line of car-ferry steamers calls at this harbor. The approximate value of the exports and imports could not be ascertained.

The project has a material effect in controlling freight rates, as the car-ferry steamers form a lake-and-rail route between eastern and western points. It is impracticable to estimate the amount of reduction in rates thereby affected.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs to piers and dredging for maintenance of channel.

For references to more extended information, maps, and reports on examination and survey, see Annual Report for 1904, page 525, and 1908, page 670.

July 1, 1908, balance unexpended	$4,995.19
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
Miscellaneous receipts	45.42
	10,040.61
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,864.09
July 1, 1909, balance unexpended	7,176.52
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J J 9.)

10. *Two Rivers Harbor, Wisconsin.*—The original depth of the entrance to Twin rivers was from 3 to 4 feet and the present harbor was not available for purposes of commerce.

The original project adopted March 3, 1871, provided for the formation of a channel of navigable width and 13 feet deep, connecting Twin rivers with Lake Michigan by building parallel piers extending to the 19-foot contour and dredging between them, at an estimated cost of $265,588.80, modified in 1897, by terminating the piers at the 14-foot contour. The total amount expended on original and modified project was $247,613.35.

The existing project, adopted March 2, 1907, is a modification of plan "A," printed in House Document No. 730, Fifty-ninth Congress, first session, and provides for increasing the depth of channel to 16 feet and for the construction of a stilling basin on the north side of harbor. The sum of $90,000 was appropriated for the purpose.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, was $62,957.35, of which $21,379.83 was applied to maintenance.

The expenditures during the fiscal year have been for construction of new pile pier, for dredging in channel and stilling basin, for repairs of such portions of the old piers as form part of the present project, and for general supervision.

The new pile pier has been completed, the channel dredged to a depth of 16 feet, the old piers thoroughly repaired, and about three-fourths of the stilling basin has been dredged. The stilling basin has already an appreciable effect on the harbor during storms. The depth of channel has been increased about 3 feet.

The maximum draft that could be carried June 30, 1909, was about 15 feet. The mean annual variation in level of water surface is about 1 foot. East and West Twin rivers have a navigable depth of 7 feet for a distance of about 3 miles and 7 miles, respectively, from the harbor piers. There is no regular commerce on these rivers. For many years they have been used by rowboats and for floating saw logs.

Commercial statistics for 1908.—Arrivals of vessels, 238; shipments and receipts, 58,315 net tons. Estimated value of exports and imports, $296,087.

The commerce of this harbor is small in volume and of a local character. It is believed that the project has a considerable effect in controlling freight rates not only on coal for local consumption brought in by way of the harbor, but also affording Two Rivers the rail rates accorded places at which water competition exists.

The amount estimated as a profitable expenditure during the fiscal year ending June 30, 1911, is to be applied in purchasing stone for riprap and pier filling and for dredging for maintenance of channel. The additional work proposed is necessary for maintenance of the harbor.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Reports for 1904, page 526, and for 1906, pages 599 and 645.

July 1, 1908, balance unexpended		$75,065.16
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$33,799.01	
For maintenance of improvement	12,736.85	
		46,535.86
July 1, 1909, balance unexpended		28,529.30
July 1, 1909, outstanding liabilities		862.02
July 1, 1909, balance available		27,667.28
July 1, 1909, amount covered by uncompleted contracts		15,728.48
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		5,000.00

(See Appendix J J 10.)

11. Manitowoc Harbor, Wisconsin.—The original depth of water at the mouth of the Manitowoc River was about 4 feet at the shoalest point, and the existing harbor was not available for purposes of commerce.

The original project, adopted in 1854, provided for building parallel piers 220 feet apart and dredging between them to obtain a channel 12 feet in depth connecting Manitowoc River with Lake Michigan, modified as follows: 1881, provided for extending piers to 19½-foot contour and increasing depth to 19 feet at entrance and 15 feet at the shore line; 1890, provided for an exterior breakwater 400 feet long, 24 feet wide; 1896, provided for increasing depth of channel to 20 feet and extending south pier 500 feet; 1902, provided for extending the breakwater 400 feet. The original project as subsequently modified was completed in 1903. The total amount expended thereon, including maintenance up to the time of adoption of present projects, is $454,666.79.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 20-foot channel and for the reconstruction of the harbor by the removal of outer 500 feet of existing breakwater and nearly all of the old parallel piers and by construction of new breakwaters and piers in accordance with report submitted in House Document No. 62, Fifty-ninth Congress, first session, as modified by Board of Engineers for Rivers and Harbors; estimated cost, $376,000.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1909, was $397,146.04, of which $162,897.56 was for maintenance.

The expenditures during the fiscal year have been for breakwater and pier construction, for dredging, construction of survey boat, repairs of plant, and for general supervision.

The work has been done under continuing contract appropriations, and the balance of the authorization to be appropriated is $5,500.

The existing project is completed with the exception of the rubble mounds and a moderate amount of dredging. No increase in depth has been obtained, but the present harbor affords greatly increased protection to the entrance to the river, having an excellent stilling effect during storms.

The maximum draft that could be carried June 30, 1909, was about 19½ feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the western end of the government improvement, Manitowoc River is navigable for a distance of about 1.8 miles.

Commercial statistics for 1908.—Arrivals of vessels, 1,593; shipments and receipts, 1,420,524 net tons. The approximate value of the exports and imports could not be ascertained. The commerce is very large in volume and of a general character. Two lines of car-ferry steamers call at this harbor daily throughout the entire year.

The project has a material effect in controlling freight rates, as the car-ferry steamers form lake and rail routes between eastern and western points. It is impracticable to estimate the amount of reduction in rates thereby affected.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in building concrete superstructure on north breakwater and on concrete caisson breakwaters and in dredging for maintenance of channel. The additional work proposed is necessary for maintenance of the harbor.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Reports for 1904, page 526, and 1906, page 645.

July 1, 1908, balance unexpended		$326, 136.44
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$231, 072.11	
For maintenance of improvement	17, 564.44	
		248, 636.55
July 1, 1909, balance unexpended		77, 499.89
July 1, 1909, outstanding liabilities		8, 041.27
July 1, 1909, balance available		69, 458.62
July 1, 1909, amount covered by uncompleted contracts		14, 187.00
Amount (estimated) required for completion of existing project		5, 500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		35, 000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix J J 11.)

12. Sheboygan Harbor, Wisconsin.—The depth of water over the bar at the mouth of the Sheboygan River originally did not exceed 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1866, provided for extending the piers built by the city and county of Sheboygan to the 13-foot contour and dredging between them to a depth of 13 feet; modified as follows: 1873, for a deeper channel and pier extension; 1881, for extending piers to 21-foot contour and a depth of 19 feet at entrance, diminishing to 15 feet at shore line; 1894, for increasing width between piers and for a channel 19 feet deep; 1899, for a breakwater 700 feet long; 1902, for extending both piers and increasing depth of channel to 21 feet. The original project as modified was completed in 1904 with the exception of 100 feet of breakwater. The total amount expended thereon, including maintenance, up to the time of adoption of present project, is $575,099.44.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot channel and works incident thereto, for extension of north breakwater, for a south breakwater, and for subsequent necessary extensions to each breakwater in general accordance with type plan as set forth in report submitted in House Document No. 62, Fifty-ninth Congress, first session.

An estimate of the cost of a part of this project, amounting to $253,000, was submitted December 13, 1906, and published in River and Harbor Committee Document No. 3, Fifty-ninth Congress, second session. The Board of Engineers for Rivers and Harbors in its report on this project, published in the same committee document, stated that it was the belief of the Board that the proposed plan "should be held in abeyance until the completion of the proposed improvements at Ludington and Manitowoc, and that the adoption of a new plan for the improvement of any of these other harbors" (including Sheboygan) "should be postponed until the efficiency of the work at these two harbors is demonstrated." At the date of this report the work at neither Ludington nor Manitowoc has been fully completed, and it is believed that at the close of the present season the department will be in better position than at present to submit further recommendation in regard to the work now held in abeyance in consequence of this report of the Board.

Should it be decided, however, not to hold the proposed plan further in abeyance, it is believed that the work of improvement should in the immediate future be confined to extending the north breakwater shoreward as recommended by the district officer.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1909, was $43,334.95, of which $14,444.64 was for maintenance.

The expenditures during the fiscal year have been for extension of breakwater, for dredging for restoration of channel, for construction of survey boat, for repairs of plant, and for general supervision.

It is estimated that not more than 5 per cent of the approved project has been completed up to June 30, 1909. No result in the way of increased depth or width has been obtained, but the extension to the breakwater has somewhat diminished the disturbances in the harbor during storms.

The maximum draft that could be carried June 30, 1909, was about 19 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the westerly end of the government improvement, Sheboygan River is navigable for a distance of 1¼ miles.

Commercial statistics for 1908.—Arrivals of vessels, 661; shipments and receipts, 616,832 net tons. The approximate value of the exports and imports could not be ascertained. The commerce of Sheboygan is quite large and of a general character. It is believed that the project has a material effect in controlling freight rates not only on coal and other bulk commodities, both local and for transshipment, but also in affording to Sheboygan the rail rates accorded places at which water competition exists.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and breakwater, and in dredging for maintenance of channel. The proposed work is necessary for maintenance of the harbor.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Reports for 1904, page 527, and 1906, page 645.

July 1, 1908, balance unexpended		$36,250.24
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		41,250.24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$15,519.19	
For maintenance of improvement	12,345.98	
		27,865.17
July 1, 1909, balance unexpended		13,385.07
July 1, 1909, outstanding liabilities		330.72
July 1, 1909, balance available		13,054.35
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		65,000.00

(See Appendix J J 12.)

13. Port Washington Harbor, Wisconsin.—The natural channel at the mouth of the Sauk River was narrow, and at the shoalest point had a depth of 1 foot. The present harbor was not available for purposes of commerce.

The original project, adopted in 1869, provided for a channel between parallel piers, 150 feet apart, extending from the shore to the 11-foot contour, and for a basin 600 feet long by 200 feet wide, inside the shore line, modified as follows: June 7, 1877, extending piers to 15-foot contour and a second basin to the northward and nearly at right angles to the first basin, the depth in channel and basins to be 13 feet. The original project, as modified, is the existing project. Estimated cost, $181,527.17.

The amount expended up to June 30, 1909, was $202,901.29, of which $14,337.96 was for maintenance. Of this amount $68.25 was derived from miscellaneous sources.

The expenditures during the fiscal year have been for maintenance of channel and for general supervision.

The existing project was completed in 1895 at a cost of $188,563.33. Since then all expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1909, was about 12 feet. The usual mean annual variation of levels of water surface is about 1 foot.

Commercial statistics for 1908.—Arrivals of vessels, 1,277; shipments and receipts, 32,988 net tons. The approximate value of the exports and imports could not be ascertained. The commerce benefited is small in volume and of a local character. It is believed that the project has a considerable effect in controlling freight rates, not only in coal for local consumption brought in by way of the harbor, but also in affording Port Washington the rail rates accorded places where water competition exists.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and dredging. The work proposed is necessary for maintenance of the harbor.

For references to more extended information and for reports on examinations and surveys see Annual Report for 1904, pages 528 and 2899.

July 1, 1908, balance unexpended	$3,022.10
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	7,022.10
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	955.14
July 1, 1909, balance unexpended	6,066.96
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix J J 13.)

14. Milwaukee Harbor, Wisconsin, including harbor of refuge.—Milwaukee Harbor and the harbor of refuge, which were originally separate works, were consolidated by the act of June 13, 1902.

The original depth of water at the mouth of the Milwaukee River was not more than 4½ feet, and the present harbor was not available for purposes of commerce; but the situation of the entrance, in a bay protected from storms, except those from northeast to southeast, and the 7 miles of interior river easily susceptible of improvement, have made the problem of obtaining a harbor a relatively inexpensive one.

The original project for the improvement of Milwaukee Harbor was adopted in 1845–46, and provided for dredging the original river mouth and protecting the entrance by parallel piers, modified as follows: 1852, provided for the formation of a channel 260 feet wide and 13 feet deep, located 3,000 feet to the northward of original mouth of the Milwaukee River, by dredging across the overlapping point and protecting the channel by parallel piers, each 1,120 feet long; 1868, provided for extending each pier 600 feet; 1899, provided for deepening the channel to 21 feet; 1902, provided for concrete superstructure on 1,050 feet of the north pier; 1905, provided for completing concrete superstructure on north pier, a distance of 600 feet.

The original project for the harbor of refuge was adopted in 1881 and provided for a breakwater 7,650 feet long, including an opening therein of 400 feet; the acts of 1902 and 1905 provided for concrete superstructure on 3,450 feet of the northern end of the breakwater.

These original projects as modified were completed in 1906. The total amount expended thereon, including maintenance up to the time of adoption of the present project, is $1,739,040.88.

The act approved March 2, 1907, provides for maintenance of 21-foot channel, rebuilding south pier, building 3,800 feet of concrete superstructure on breakwater, and modifies the project by providing for an extension of the breakwater 1,000 feet. Estimated cost, $592,000.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1909, was $448,224.54, of which $342,375.56 was for maintenance.

The expenditures during the fiscal year have been for concrete superstructure on breakwater, for breakwater extension, for rebuilding south pier, for construction of survey boat, for repairs of plant, and for general supervision. About 7,200 linear feet of concrete superstructure has been completed. All the cribs for breakwater extension have been sunk and the superstructure thereon has been nearly completed. Work on the south pier has been commenced.

The work is in progress under continuing contract appropriation, authorizing an expenditure of $592,000, all of which has been appropriated.

The approved project is practically completed with the exception of the south pier, work on which has just been commenced.

The maximum draft that could be carried June 30, 1909, was 21 feet. The mean annual variation of level of water surface is about 1 foot.

Commercial statistics for 1908.—Arrival of vessels, 5,080; shipments and receipts, 5,375,013 net tons. The approximate value of the exports and imports could not be ascertained.

Milwaukee stands among the leading lake ports in the extent and value of its water-borne commerce. To Milwaukee 3,829,372 tons of coal was brought in 1908, to be locally consumed or distributed to points in the interior. By means of car ferries, which ply both winter and summer, Milwaukee is connected with several railway systems terminating on the east shore of Lake Michigan.

By reason of its excellent harbor the manufacturers and distributors of Milwaukee enjoy superior shipping facilities and low freight rates, especially to and from eastern points. Many bulky articles, such as coal, salt, sugar, etc., are transshipped from water to rail at Milwaukee. The favorable effect of the harbor upon commerce is widespread throughout several States lying to the westward.

For references to more extended information and for reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1904, pages 529 and 530.

July 1, 1908, balance unexpended		$467,932.86
Miscellaneous receipts		584.53
		468,517.39
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$104,560.68	
For maintenance of improvement	175,512.93	
		280,073.61
July 1, 1909, balance unexpended		188,443.78
July 1, 1909, outstanding liabilities		9,987.57
July 1, 1909, balance available		178,456.21
July 1, 1909, amount covered by uncompleted contracts		132,821.03

(See Appendix J J 14.)

15. *Milwaukee (inner) Harbor, Wisconsin.*—The original condition of the rivers comprised in the inner harbor of Milwaukee is not definitely known. These rivers have been dredged, and a depth of about 21 feet below datum maintained therein, by the city of Milwaukee.

The original project, which is the existing project, was adopted by act of March 3, 1905, and provides for improving Menominee, Milwaukee, and Kinnickinnick rivers, which constitute the inner harbor of Milwaukee. This project provides for the excavation of four turning basins—one in the Menominee and three in the Kinnickinnick; the excavation of a channel 100 feet wide from the turning basin in Menominee River to its mouth and 150 feet wide thence to the harbor entrance; the excavation of a channel 100 to 150 feet wide from the mouth of the Kinnickinnick to the uppermost turning basin in that river, all channels to be 21 feet deep. The estimated cost of this improvement is $318,581. The act in adopting the project provided that no part of the appropriation therefor should be expended unless the Secretary of War shall have satisfactory assurance that the city of Milwaukee will comply with certain conditions. Stated briefly, the city must donate the land for the turning basins, must revert channels and basins wherever necessary, and must maintain the improvement after its completion.

By act approved June 30, 1906, Congress authorized the Secretary of War, in his discretion, to modify this project by omitting the turning basin at the head of navigation in the Kinnickinnick River.

By act approved May 28, 1908, Congress authorized the Secretary of War, in his discretion, to enter into a contract or contracts for the improvement of the Kinnickinnick River, as soon as the city of Milwaukee shall have complied with the foregoing conditions, so far as they apply to the Kinnickinnick River, or any part thereof.

There has been no expenditure under the existing project, no assurance having yet been offered that the city of Milwaukee will fulfill all the conditions above mentioned.

The work is to be done under continuing-contract appropriations, and the balance of the authorization to be appropriated is $218,581.

No portion of the approved project has been accomplished up to June 30, 1909.

The maximum draft which could be carried June 30, 1909, was about 20 feet. The usual mean annual variation of water surface is about 1 foot. The rivers are actually navigable as follows: Milwaukee River, about 2¾ miles; Menominee River, about 2 miles; Kinnickinnick River, about 2¼ miles.

The commerce of Milwaukee has already been described in the report relating to Milwaukee Harbor.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore, both locally and for transshipment. It is impracticable to estimate the amount of reduction in rates thereby effected.

For report on examination and survey see Annual Report for 1904, Part 3, page 2887.

July 1, 1908, balance unexpended	$100,000.00
July 1, 1909, balance unexpended	100,000.00
Amount (estimated) required for completion of existing project	218,581.00

(See Appendix J J 15.)

16. Racine Harbor, Wisconsin.—The entrance to this harbor at the mouth of Root River originally varied in depth from absolute closure after storms to about 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1842–43, provided for a channel 13 feet deep between parallel piers 160 feet apart, modified as follows: 1866, provided for increasing depth to 16 feet and for extension of piers; 1889, provided for increasing depth to 17 feet and for further extension of piers; 1899, provided for widening channel and increasing depth to 21 feet, for extending the south pier, and for a breakwater 600 feet long; 1902, provided for a change in the location and direction of the breakwater. The original project as modified was completed in 1905. The total amount expended thereon, including maintenance up to the time of adoption of present project, is $507,141.72.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot channel and works incident thereto, for extension of north breakwater, for a south breakwater, and for subsequent necessary extensions to each breakwater, in general accordance with type plan as set forth in report submitted in House Document No. 62, Fifty-ninth Congress, first session.

An estimate of the cost of a part of this project, amounting to $225,000, was submitted December 13, 1906, and published in River and Harbor Committee Document No. 3, Fifty-ninth Congress, second session. The Board of Engineers for Rivers and Harbors in its report on this project, published in the same committee document, stated that it was the belief of the board that the proposed plan "should be held in abeyance until the completion of the proposed improvements at Ludington and Manitowoc, and that the adoption of a new plan for the improvement of any of these other harbors" (including Racine) "should be postponed until the efficiency of the work at these two harbors is demonstrated." At the date of this report the work at neither Ludington nor Manitowoc has been fully completed, and it is believed that at the close of the present season the department will be in better position than at present to submit further recommendation in regard to the work now held in abeyance in consequence of this report of the Board.

Should it be decided, however, not to hold the proposed plan further in abeyance, it is believed that the work of improvement should in the immediate future be confined to extending the north breakwater shoreward, as recommended by the district officer.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, is $50,525.14. Of this amount, $25,492.55 was for maintenance.

The expenditures during the fiscal year have been for extension of north breakwater, for maintenance of channel, for construction of survey boat, and for general supervision.

The breakwater has been extended about 200 feet, the channel dredged, and minor repairs made to breakwater.

It is estimated that not more than 5 per cent of the approved project has been completed up to June 30, 1909. No result in the way of increased depth or width has been obtained, but the extension to the breakwater has somewhat diminished the disturbances in the harbor during storms.

The maximum draft that could be carried June 30, 1909, was about 19 feet. The usual mean annual variation of level of water surface is about 1 foot. Connecting with the western terminus of the government improvement, Root River is navigable for a distance of about nine-tenths of a mile.

Commercial statistics for 1908.—Arrivals of vessels, 1,344; shipments and receipts, 745,032 net tons. The approximate value of the exports and imports could not be ascertained. The commerce benefited is quite large in volume and of a general character. It is believed that the project has a material effect in controlling freight rates not only on coal and other bulk commodities, both local and for transshipment, but also in affording to Racine the rail rates accorded places at which water competition exists.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and breakwater and in dredging. The work proposed is necessary for maintenance of the harbor.

For references to more extended information and reports on examinations and surveys, see Annual Reports for 1904, page 531, and 1906, page 645.

July 8, 1908, balance unexpended		$35,684.04
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
Miscellaneous receipts		50.00
		40,734.04
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$18,885.91	
For maintenance of improvement	13,380.52	
		32,266.43
July 1, 1909, balance unexpended		8,467.61
July 1, 1909, outstanding liabilities		351.68
July 1, 1909, balance available		8,115.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		80,000.00

(See Appendix J J 16.)

17. Kenosha Harbor, Wisconsin.—The original depth of water at the mouth of Pike Creek varied from nothing to 4 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1852, provided for a channel 13 feet deep between parallel piers 150 feet apart, modified as follows: 1866, provided for a navigable channel 16 feet deep; 1889, provided for extending north pier 300 feet and south pier 600 feet, and for channel 16 feet deep; 1890, provided for dredging in "The Basin;" 1899, provided for extending the south pier, increasing the width between piers to 250 feet by rebuilding the north pier, building 600 feet to breakwater, and increasing the depth in channel and basin to 21 feet and 20 feet, respectively; 1902, provided for extending the breakwater 100 feet shoreward. The original project as modified was completed in 1900, with the exception of 100 feet extension to breakwater. The total amount expended thereon, including maintenance up to the time of adoption of present project, is $475,815.37.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot entrance channel, 20-foot basin, and existing works, and for an extension of 200 feet to the landward end of the breakwater. Estimated cost, $22,000.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1909, is $23,046.40. Of this amount $14,350.18 was for maintenance.

The expenditures during the fiscal year have been for extension of north breakwater, for dredging, and for general supervision.

The foundation for breakwater extension is completed and the crib has been built but not yet sunk in place. The channel and the basin have been dredged.

The approved project is completed with the exception of sinking a crib in extension of breakwater and building superstructure thereon.

The maximum draft that could be carried June 30, 1909, was about 19 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the western terminus of the government improvement, Pike Creek is navigable for a distance of about 2,500 feet.

Commercial statistics for 1908.—Arrivals of vessels, 359; shipments and receipts, 58,545 net tons. The approximate value of the exports and imports could not be ascertained. The commerce is not large in volume and is chiefly of a local character.

It is believed that the project has a considerable effect in controlling freight rates not only on coal for local consumption brought in by way of the harbor, but also by affording Kenosha the rail rates accorded places at which water competition exists.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and breakwater dredging. The work proposed is necessary for maintenance of the harbor.

For references to more extended information and for reports on examinations and surveys, see Annual Reports for 1904, page 532, and 1906, page 645.

July 1, 1908, balance unexpended		$33,517.92
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		43,517.92
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$2,613.57	
For maintenance of improvement	13,301.00	
		15,914.57
July 1, 1909, balance unexpended		27,603.35
July 1, 1909, outstanding liabilities		101.53
July 1, 1909, balance available		27,501.82
July 1, 1909, amount covered by uncompleted contracts		22,578.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix J J 17.)

18. *Waukegan Harbor, Illinois.*—Originally there was no navigable channel or natural harbor at this place.

An appropriation of $15,000 was made in 1852 "for the improvement of the harbor and breakwater at Waukegan, Ill." The plan adopted was the construction of a breakwater parallel to the shore in about 20 feet of water and opposite the heads of two bridge piers in the open lake, from which the commerce of the place was carried on. One crib was placed in position but was carried away by a storm, and the work was abandoned.

The original project was adopted in 1880 and provided for an artificial harbor of sufficient capacity for local trade by inclosing an area with pile piers, the entrance channel and inclosed area to be dredged to 13 feet. The amount expended on original project prior to commencement of operations under present project was $218,944.41.

The existing project, adopted by act of June 13, 1902, provides for extending both harbor piers, building a breakwater, and increasing depth of channel to 20 feet; estimated cost, $345,000, all of which has been appropriated.

The total amount expended in the work of existing project up to the close of the fiscal year ending June 30, 1909, is $400,981.38; of this sum $90,641.99 was for maintenance, of which amount $72.93 was derived from miscellaneous sources.

The expenditures during the fiscal year have been for reconstruction of inshore end of south pier, and dredging for restoration of channel, and minor repairs of breakwater, repairs of plant, and for general supervision. The new south pier is practically completed, and the harbor has been dredged.

The approved project was completed in 1904. Since then all exexpenditures have been for maintenance.

The maximum draft which could be carried June 30, 1909, was about 19 feet. The usual mean annual variation of water level is about 1 foot.

Commercial statistics for 1908.—Arrivals of vessels, 660; shipments and receipts, 217,009 net tons. The approximate value of the exports and imports could not be ascertained.

The commerce affected by the project is mostly coal and salt for transshipment. Its volume is large and increasing.

It is believed that the harbor is of great convenience to general commerce, being a terminus of the Elgin, Joliet and Eastern Railway, known as the Chicago Outer Belt Line. The harbor is in close connection with all the railways entering Chicago.

It is believed that the project has a considerable effect in controlling freight rates on coal and other bulk commodities.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1911, in repairs of piers and breakwater and dredging. The work proposed is necessary for maintenance of the harbor.

For reference to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 532.

July 1, 1908, balance unexpended	$50,275.37
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	55,275.37
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	24,628.23
July 1, 1909, balance unexpended	30,647.14
July 1, 1909, amount covered by uncompleted contracts	16,365.62
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J J 18.)

19. Fox River, Wisconsin.—The Fox and Wisconsin rivers, separated at Portage, Wis., by a distance of only 2 miles, one flowing into Lake Michigan, the other into the Mississippi River, were the early means of communication between those waters. Through a board of public works the State began and carried on the improvement until 1853, when it was transferred to a private company. In 1872 the United States purchased from the Green Bay and Mississippi Canal Company all of its property except the water powers, water-power lots, and personal property.

The present project is that of a Board of Engineers, submitted September 17, 1884, and modified May 14, 1886. It provides for deepening and widening the channel of Fox River from Green Bay to Montello to 6 feet depth and from Montello to Portage to 4 feet depth, with a width of the river channel from Lake Winnebago to Montello of 100 feet, and for the renovation of 12 old locks, at an estimated cost of $602,000.

Appropriations aggregating $593,750 have been provided for this work, and a revision of the estimate indicates that $155,353.36 will be required to complete it.

The improvement of the Wisconsin River was abandoned in 1887.

The amount expended by the United States on the improvement of the Fox and Wisconsin rivers from 1839 (date of first appropriation) to the close of the fiscal year ending June 30, 1909, including about $600,000 expended for flowage damages and $145,000 paid to the Green Bay and Mississippi Canal Company for its property, was $3,810,421.96, of which amount $591,161.39 was expended solely upon the Wisconsin River.

The works on Fox River now consist of 18 stone locks, 2 stone guard locks and 8 composite locks, 13 canals, 16 permanent and 1 temporary dam, and various accessories, including lock houses, warehouses, a dry dock, levees, waste-weirs, culverts, retaining walls, etc. The harbors of Stockbridge, Calumet, Miller Bay, and Brothertown, Lake Winnebago, have been improved, and snags have been removed and bars dredged in Wolf River, making a 4-foot channel 100 feet wide to New London.

The project depth of 6 feet below mean low water has for the most part been obtained from Depere to Princeton lock, but the revision of the estimate indicates that there is still a large amount of dredging to be done in the levels between Eureka and Princeton lock, where now but 5-foot depths obtain. The dredging of the 6-foot channel between Princeton lock and Montello is now in progress, and the next appropriation will be applied to this section. The district officer recommends that no funds be expended for further work above Montello, as that portion of the river is now regarded as unworthy of improvement.

The maximum draft that could be carried June 30, 1909, at mean low water over the shoalest part of the improvement was 5 feet from Depere to Berlin lock, 4 feet from there to mile post 64 (about 11 miles above Princeton lock) and 3 feet from mile post 64 to Portage, the head of navigation on the Fox River.

July 1, 1908, balance unexpended	$52,558.37
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
Miscellaneous receipts	1.65
	72,560.02
June 30, 1909, amount expended during fiscal year, for works of improvement	23,880.52
July 1, 1909, balance unexpended	48,679.50
July 1, 1909, outstanding liabilities	2,674.42
July 1, 1909, balance available	46,005.08
Amount (estimated) required for completion of existing project	155,353.36

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	$50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J J 19.)

20. Operating and care of locks and dams on Fox River, Wisconsin.—Under the allotment from the indefinite appropriation for operating and care of canals and other works of navigation there has been expended during the year ending June 30, 1909, the sum of $52,940.17.

The amount expended to June 30, 1909, is $1,407,405.74, including $3,314.67 miscellaneous receipts.

The principal work done has been dredging bars and channels; making repairs to locks, dams, and canal banks, lock houses, dredges, and boats; renewing the timber work and concrete top finish of Little Kaukauna lock above low water; rebuilding the lower gates of Kaukauna third and fourth locks and the upper part of the gates of Appleton first lock; rebuilding the sluice gates of Menasha Dam of steel, and the construction of lock houses at Little Chute first and Combined locks.

The report of the district engineer officer in charge shows the items of expenditures. Navigation was closed November 20, 1908, and reopened April 12, 1909.

For commercial statistics, see report of the district officer upon the improvement of Fox River, Wisconsin.

(See Appendix J J 20.)

21. Removing sunken vessels or craft obstructing or endangering navigation.—Wreck of steamer Cecelia Hill at Eagle Harbor, Green Bay, Wisconsin.—This vessel burned at Fish Creek, Wis., some two or three years ago. The hull was subsequently towed to Horseshoe Island, lying at the entrance to Eagle Harbor, Green Bay, Wis., and was permitted to sink, thus forming an obstruction to navigation.

The wreck having been abandoned by its owners, it was removed by the United States on September 14, 1908, at a cost of 24 cents and the vessel and its contents.

(See Appendix J J 21.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST CHICAGO, ILLINOIS, DISTRICT.

This district was in the charge of Col. W. H. Bixby, Corps of Engineers, to September 30, 1908, and of Maj. Thomas H. Rees, Corps of Engineers, since that date. Division Engineer Col. W. L. Fisk, Corps of Engineers.

1. Chicago Harbor, Illinois.—Before improvement (1870) this harbor was limited to the lower end of Chicago River, with an entrance channel width of 400 feet, depth 13 feet, and annual commerce less than 3,000,000 tons. A brief history of this harbor improvement prior to 1876 is given on pages 433 to 438, Part 2, Annual Report of the Chief of Engineers for 1876, and a very full description of the harbor in its improved condition is to be found on pages 131 to 134, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich.

The present project was adopted in 1870, modified in 1878, 1896, 1903, and 1905; that for present increased depth of dredging in outer harbor being given by report of July 16, 1897 (p. 2791, Annual Report of the Chief of Engineers for 1897), specifically adopted by act of March 3, 1899; and that for repair of north pier being given by report of July 14, 1903 (p. 1888, Annual Report of the Chief of Engineers for 1903), adopted by act of March 3, 1905; such projects including:

(*a*1) Breakwaters to form an outer harbor, with (*a*2) dredging within the same for 20-foot draft (21 foot depth).

(*b*) Exterior breakwater, with a harbor of refuge behind the same.

(*c*) Dredging entrance to inner harbor or mouth of Chicago River to same depth as outer harbor.

(*d*) Maintenance; including (*d*1) the special repair of north pier superstructure and (*d*2) some redredging outside the southern entrance to the basin.

(*e*) Contingencies, including superintendence.

For map of full improvement, see page 1888, Annual Report of the Chief of Engineers for 1903.

No preliminary examination reports appear to be on record as to past improvements of this locality.

A list of past survey reports will be found on page 600, Annual Report of the Chief of Engineers for 1906.

There has been expended on projects prior to 1870, $446,005, and on the project of 1870, with its modifications, to June 30, 1909, the sum of $2,106,687.37; total, $2,552,692.37.

The operations during the year were: Completion of the concrete superstructure over the north pier; completion of pile protection pier at United States life-saving station and United States engineer boathouse (one-half of the cost of which was paid for by the Life-Saving Service); redredging the channel from the lake to Rush Street Bridge; repairs to north end of easterly breakwater. All of the work above mentioned is that of maintenance except the construction of the small protection pier at the life-saving station.

The uncompleted portions of the above project now are (*a*2) completion of dredging of the outer harbor basin for a 20-foot draft, estimated July 16, 1897, at $509,960; (*d*2) reopening (dredging) of the east (also called southern) entrance to the outer harbor basin; (*d*4) repair of outer harbor breakwater cribs and filling; (*d*5) repair of exterior harbor of refuge breakwater; (*e*) contingencies, including superintendence.

At present the harbor entrance has a width of 470 feet at the river mouth, with a least depth of 21 feet via Chicago River, and of about 16 feet via the basin entrance; and the harbor basin carries depths of at least 19 to 20 feet over its outer half and of at least 8 feet over its inner half; all these depths being referred to "Chicago city datum," or the so-called "low water of 1847," which is 579.83 feet above mean tide, New York Harbor (Lake Survey revisions of 1907).

The water level has a total variation of about 6.5 feet from highest known to lowest known water, and an average of less than 1 foot oscillation per day.

Chicago outer harbor, being mainly a protection to Chicago River entrance, has practically no commerce except that of the river, the outer basin being used mainly by yachts and other small craft. The lake commerce of this locality is at present diminishing and the harbor works, while formerly having added about 5,000,000 tons to the river commerce, are now needed mainly to prevent a more rapid loss of the 4,000,000 tons remaining.

The existence of this improved harbor is considered to be of great use in controlling freight rates.

By act approved May 28, 1908 (Public, No. 153), any or all of the then available balance for Chicago Harbor was made available, in the discretion of the Secretary of War, for expenditure on the existing project for Chicago River, and under this authority $193,000 of Chicago Harbor funds has been transferred to Chicago River.

The superstructures of the easterly and southerly breakwaters have deteriorated to such an extent that rebuilding in concrete is now considered necessary, and the cost thereof is included in the amount that can be profitably expended in the fiscal year ending June 30, 1911.

It is proposed to apply the available funds and those asked for the fiscal year ending June 30, 1911, to the maintenance of existing works, redredging the southern entrance to the outer harbor and rebuilding in concrete the superstructures of the easterly and southerly breakwaters, meanwhile postponing the completion of the outer basin dredging, which is not considered urgent.

By the act of March 3, 1909, Congress ordered an examination to be made of the rivers and harbors in the Chicago district for the purpose of reporting a plan for a complete, systematic, and broad improvement of harbor facilities for Chicago and adjacent territory. This report will be submitted to Congress at its next session.

July 1, 1908, balance unexpended		$279,426.01
Amount transferred to Chicago River		193,000.00
		86,426.01
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$4,678.89	
For maintenance of improvement	45,498.03	
		50,176.92
July 1, 1909, balance unexpended		36,249.09
Amount (estimated) required for completion of existing project		237,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		480,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix K K 1.)

2. *Chicago River, Illinois.*—Before improvement by the United States (1896) the river channel, as a result of municipal and private improvements, was navigable for about 14-foot draft boats over widths of about 200 feet throughout the length of the main river, about 1.5 miles, and of use by boats of 12 to 14 feet draft for lesser widths and for about 5 miles farther length in the North Branch and about 5 miles farther length in the South Branch and forks. A good brief history of river and harbor improvement at Chicago prior to 1876 is given on pages 433–438, Part 2, Annual Report of the Chief of Engineers for 1876, and a very full description of present conditions is to be found on pages 134–144, Bulletin No. 18 (1908), issued by the

United States Lake Survey Office, Detroit, Mich. For maps of river and turning basins, see pages 1892–1893, Annual Report, 1903.

Past projects, from 1896 to 1902, provided for 16 feet draft through this river. Under such projects 17 feet actual depth below city datum was secured from the mouth of the river via South Branch and West Fork to Ashland avenue (about 5.5 miles), via South Branch and South Fork to the stock yards (about 6 miles), and via North Branch to Belmont avenue (about 6 miles). (See p. 2974, Annual Report of the Chief of Engineers for 1893; p. 2793, Report for 1897, and p. 3865, Report for 1900, for full reports on history of improvement and needs up to 1899.)

The project of July 2, 1902, estimated cost $500,000, as specifically covered by act of Congress June 13, 1902, provided for two large turning basins (one in the North Branch and one in the South Branch), to be dredged to 20 feet draft (21 feet depth). These turning basins have been completely dredged and partly docked, but will need some annual redredging and probably some further dock revetment.

The river and harbor act, March 2, 1907, appropriated $300,000 for improvement and maintenance of this river, such work being covered by the survey report of November 14, 1899 (pp. 3865–3871, Annual Report of the Chief of Engineers for 1900), and providing for dredging to 21 feet actual depth in mid-channel and to within 20 feet of dock lines from Ogden slip at the river mouth to Ashland avenue on the South Branch, to the Indiana State line bridges on the South Fork, South Branch, and to Belmont avenue on the North Branch (including also the canal around Goose Island, North Branch), all originally estimated at $810,600. Project covering this work was approved April 11, 1908, as follows:

(*a*) Dredging soft material, main river, North Branch (including canal), South Fork of South Branch, 1,472,000 cubic yards	$384,000
(*b*) Excavation rock and hardpan in North Branch and South Fork, 105,000 cubic yards	352,800
(*c*) Superintendence and inspection	73,800
	810,600

the division of funds between dredging and excavation being subject to modification during the progress of work.

A list of past survey reports will be found on page 601, Annual Report of the Chief of Engineers for 1906.

Reference to reports on examination and survey of West Fork of South Branch of Chicago River, ordered by the river and harbor act of March 3, 1905, will be found on page 608, Annual Report of the Chief of Engineers for 1906. A new report on the same locality was called for by the river and harbor act of March 3, 1909, and will be submitted to Congress at its session.

The head of navigation of the river and its branches, together with a statement of its navigable lengths, are given in the following table:

	Miles.
Main river from end of piers to junction of branches	1.58
South Branch to Ashland avenue	4.08
South Fork of South Branch to Chicago Junction Railway bridges	1.71
North Branch to Belmont avenue	5.14
North Branch Canal (Goose Island Cut-off)	1.04
Total	13.55

There has been expended on previous projects $929,899.14 (of which $3,326.99 was for maintenance during the present fiscal year), and on the present project, approved April 11, 1908, $309,266.97; total, $1,239,166.11.

The following work was accomplished during the year: 484 linear feet of dock built in the South Branch turning basin; main river deepened to project depth from Rush Street Bridge to the forks; North Branch, including North Branch Canal, dredged to project depth to 900 feet north of Clybourn place; South Fork, South Branch, dredged to project depth from the South Branch turning basin at Fuller street to the junction with its west arm. Nothing has been expended for maintenance.

At present the river, including both branches, slightly widened at its narrowest parts by the United States and much widened in the South Branch by the Chicago Sanitary District, has a least depth of channel, as referred to Chicago city datum, of 21 feet from the lake to the forks; thence in the North Branch 21 feet, including North Branch Canal, to 900 feet north of Clybourn place, thence 8 feet to Fullerton avenue, thence 7 feet to Belmont avenue; and in the South Branch 21 feet to the junction with its west arm, except at Archer avenue, where the city's water-pipe tunnel restricts the depth to 19 feet below hydraulic grade. (For general description of the sanitary district projects, see p. 2097, Annual Report of the Chief of Engineers for 1902.)

The water level has variations of about 6.5 feet from the highest known to lowest known water, and an average of less than 1 foot per day. The river has a current from the lake toward the Sanitary District Canal varying from nothing up to about 3 miles per hour, according to drainage diversion and lake seiches.

The annual commerce is now reported at about 4,000,000 tons, the principal items being grain, lumber, coal, and salt (a good deal of commerce having, since 1897, gone to the Calumet River), and the present further improvement is now mainly needed to prevent further loss. There is quite a large local commerce carried in the Chicago River by lighters, of which no official record is kept.

The development of commerce on this river is greatly hampered by the many obstructive bridges crossing the stream which are owned by the city of Chicago.

The existence of this improved river is considered to be of great use in controlling freight rates.

By act approved May 28, 1908 (Public—No. 153), any or all of the available balance for Chicago Harbor was made available, in the discretion of the Secretary of War, for expenditure on the existing project for Chicago River, and under this authority $193,000 of Chicago Harbor funds was transferred to Chicago River.

It is proposed to apply the funds now available and further appropriations to the completion of the turning basins, to the securing of the new 21-foot depth throughout the river, and to the maintenance of existing works.

July 1, 1908, balance unexpended		$341,847.58
Transferred from Chicago Harbor		193,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		539,847.58
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$319,508.58	
For maintenance of improvement	3,326.99	
		322,835.57
July 1, 1909, balance unexpended		217,012.01
July 1, 1909, outstanding liabilities		13,000.00
July 1, 1909, balance available		204,012.01
July 1, 1909, amount covered by uncompleted contracts		134,609.51
Amount (estimated) required for completion of existing project		317,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		$332,600.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix K K 2.)

3. *Calumet Harbor, Illinois.*—This harbor is known on the Great Lakes as South Chicago Harbor.

Before improvement (1870) this harbor was limited to the lower end of Calumet River and to the natural depths over the bar at its lake mouth, the channel entrance having about 100 feet available width, with about 4 feet depth. The annual commerce was practically nothing in either harbor or river. A brief history of this harbor improvement prior to 1876 is given on pages 441–444, part 2, Annual Report of the Chief of Engineers for 1876; and a very full description of present conditions is to be found on pages 124–125, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich.

This improvement was designed to furnish a safe and practicable entrance to Calumet River and the port of South Chicago by the construction of parallel piers 300 feet apart, projecting from the shore into Lake Michigan, and by dredging between them.

The work began in 1870, and all the projected work for 16 feet draft was accomplished prior to June 30, 1896, resulting in the construction of 3,640 linear feet of north pier and 2,020 linear feet of south pier, and securing and maintaining a channel 16 feet deep and of suitable width from water of similar depth in Lake Michigan to the Calumet River at the roots of the piers, at a cost of $454,483.53.

The present project, submitted February 21, 1896, and specifically adopted by Congress by act of March 3, 1899 (including minor changes submitted March 28, 1899, modified July 1, 1902, and approved by Secretary of War July 11, 1902), provides for—

(*a*) A breakwater 4,400 feet long, connected with the shore and running due east into the lake, terminating in water 32 feet deep.

(*b*) An extension of this breakwater 2,500 feet long in a southeasterly direction from the end of the first.

(*c*) The anchorage area sheltered by breakwater dredged to 20 feet draft (21 feet depth).

(*d*) South pier at the mouth of Calumet River extended 800 feet.

(*e*) The Calumet River dredged to a width of 200 feet and 20 feet draft (21 feet depth) for a distance of 2 miles from the mouth.

(*f*) Maintenance and repairs.

For text and map, including minor changes, see pages 2583–2588, Annual Report of the Chief of Engineers for 1896, and page 2102 of the report for 1902.

A statement of past examination and survey reports will be found on page 603, Annual Report of the Chief of Engineers for 1906.

There has been expended on previous projects $454,484.53, and on the present project of 1896, adopted in 1899, $1,024,259.91, of which $39,180.95 was for maintenance; total, $1,478,744.44.

The operations during the year consisted of maintenance, considerable repair work having been made necessary by damage to breakwaters by storms.

All original work of past and existing projects has now been completed, leaving since 1905 only its repair and other maintenance.

At present the protected harbor behind the lake breakwater is about one-half square mile in area, with 20 feet depth; and the pier entrance to the river is of 300 feet width, with at least 20 feet channel depth; all depths being referred to Chicago city datum. (See Chicago Harbor report.)

Recent soundings indicate that some shoaling has occurred in the protected area. Considerable further damage has been done to the breakwater structures by storms of the past winter. About 900 feet of the north pier and about 300 feet of the south pier are in a very dilapidated and rotten condition and must soon be rebuilt, as these structures have now exceeded by several years the customary life of such structures. When the rebuilding is done concrete construction should be used.

The water level has a total variation of about 6.5 feet from the highest known to lowest known water, and an average of less than 1 foot oscillation per day.

Calumet Harbor, being mainly a protection to Calumet River entrance, has practically no commerce except that of Calumet River, although about half of the Illinois Steel Company's commerce, belonging partly to the harbor and partly to the river and estimated herewith, as usual, under Calumet River, belongs strictly to the harbor. The harbor works are fully entitled to half the credit of all the commerce developed by the combined harbor and river improvements since 1870, such development having now reached about 6,000,000 tons annually.

The existence of this improved harbor is considered to be of great use in controlling freight rates, and is claimed to save at least 50 cents per ton over Chicago River rates, and more over the usual Calumet (South Chicago) railroad rates.

It is proposed to apply the funds now available and the additional appropriation recommended to the necessary repair and other maintenance of the works.

July 1, 1908, balance unexpended	$110,508.37
June 30, 1909, amount expended during fiscal year for maintenance of improvement	22,021.81
July 1, 1909, balance unexpended	88,486.56
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a]100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K K 3.)

4. Calumet River, Illinois and Indiana.—Before improvement of Calumet Harbor by the United States (1870), this river, while having a navigable channel of about 100 feet width and 13 feet depth for about 4 miles length, could not be reached from the lake by boats of over 5 feet draft, because of the bar across its mouth; and its commerce was then practically nothing. At the time of the improvement of the river itself (1884), the river had become navigable for 12 feet draft over widths of about 100 feet and a length of about 4 miles; and for boats of 5 feet draft over widths of about 50 feet and lengths from the river mouth of about 16 miles in the Grand Calumet and about 14 miles in the Little Calumet. The commerce at that time was, however, less than 500,000 tons. A good brief history of this river and harbor improvement prior to 1876 is given on pages 441–444, Part 2, Annual Report of the Chief of Engineers for 1876, and a very full description of present conditions is to be found on pages 125–128, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich.

The project for the improvement of this river, adopted by Congress in 1884 and modified in 1886, contemplated securing a channel 200 feet in width and 16 feet in depth below low water in Lake Michigan from the mouth of Calumet Harbor, Illinois, about 11 miles upward, to a point one-half mile east of Hammond, Ind. This project was modified by the river and harbor act of June 3, 1896, for Calumet Harbor, so as to provide for dredging the channel to 20 feet depth from the mouth 2 miles southward (upward).

The projects of 1884 to 1896, now ended, secured a permanent channel of 200 feet width and 20 feet depth from the mouth of the river about 2.5 miles upstream (including a small turning basin near the mouth of the river), thence 16 feet depth about 3 miles farther, except over short portions, where rock reduced the width to 85 feet and the depth to 14 feet; and, in addition a temporary channel of 10 feet depth and 60 feet width, in the next 6 miles, up to a point on the Grand Calumet one-half mile east of Hammond, Ind. (about 11 miles above the mouth).

The present projects, adopted by act of March 3, 1905, provided for a channel 200 feet wide and 20 feet deep from the mouth of the river to One hundred and twenty-second street, and of the same width and 16 feet deep from One hundred and twenty-second street to the forks, with five turning basins, at a total estimated cost of $662,480.50, and $10,000 per annum for maintenance. (See p. 605, Annual Report of the Chief of Engineers for 1906.) The construction of the turning basins was made contingent upon the donation of the necessary land to the United States free of cost.

---

[a] This estimate may be reduced to $30,000, owing to the fact that joint resolution of Congress approved June 25, 1909, authorizes the retention of a balance ($68,804.89) of former appropriations for this work, which it was expected at the time this estimate was prepared would be covered into the surplus fund of the Treasury under the provisions of section 10 of the sundry civil act of March 4, 1909.

(For estimates in full, see pp. 2942–2949, Annual Report of the Chief of Engineers for 1904; for map, see p. 1902 of the Report for 1903; also, for fuller details, see House Document No. 172, Fifty-eighth Congress, second session.)

For this work $712,500 has been appropriated, thus providing for the entire project and allowing five years (1905–1910) of maintenance at $10,000 per year.

Under appropriation of August 18, 1894, for "above the forks," $5,050.75 is still available, but dredging has been discontinued because of constant refilling.

The act of June 13, 1902, authorizes the Secretary of War to accept deeds, free of expense to the United States, for lands necessary to make a proper channel 200 feet wide from the forks up to a point one-half mile above Hammond, Ind. (a stretch of about 5.5 miles).

A statement of past examination and survey reports will be found on page 605, Annual Report, 1906, and reference to report on examination made in compliance with act of March 2, 1907, will be found on page 681, Annual Report, 1908.

There has been expended on previous projects $445,768.23, including $41,718.98 for maintenance, and on the present project (adopted in 1905) $413,702.31, of which $3,511.50 was for maintenance; total, $859,470.54.

The following work was accomplished during the year: Under continuing-contract authorization the channel was dredged to a depth of 17 feet and width of 200 feet from a point about 300 feet below the Calumet and Western Railroad bridge for a distance of about 3,200 feet. The excavation of turning basin No. 1, near Ninety-third street, to 650 feet diameter and 21 feet depth was completed. Nothing has been expended for maintenance.

Expenditures up to date have resulted in a channel of 21 feet depth (Chicago datum) from the river mouth to One hundred and sixth street, with 300 feet width at the harbor piers, diminishing to 200 feet width at about Ninety-second street, retaining 200 feet width to One hundred and sixth street (except at bridges); thence 20 feet depth with 200 feet width to One hundred and eleventh street; thence 21 feet depth with 200 feet width to One hundred and fourteenth street; thence 21 feet depth with 180 feet width to One hundred and twenty-second street; thence 17 feet depth with 180 feet width to near the Calumet Western Railroad bridge (near One hundred and twenty-fourth street); thence 17 feet depth and 200 feet width to about 200 feet above the New York, Chicago and St. Louis Railroad bridge; thence about 5 feet mid-channel depth and 100 to 150 feet river width (undredged) to the forks, now under contract to be deepened to 17 feet depth and 200 feet width; thence about 5 feet depth with about 50 feet width (dredged prior to 1895 to 10 feet depth and to 60 feet width, but since partly filled up) to Hammond, Ind. One turning basin has been dredged just above Ninety-second street with 650 feet least diameter and about 21 feet depth.

The river is further navigable for 6-foot draft boats to Riverdale on the Little Calumet, 12 miles from the river mouth. It can also be used by light-draft launches, such as can pass under bridges, nearly to Gary on the Grand Calumet, about 20 miles from the river mouth, and to Blue Island on the Little Calumet, about 14 miles from the river mouth, being stopped at that point by rapids.

The water level has variations of about 6.5 feet from highest known to lowest known water, and an average of less than 1 foot per day. At dead low water the river is practically level from the lake up to the junction of the Grand and Little Calumet. The current is very slight except during freshet and lake seiches.

Slow progress is being made in the acquisition of lands for widening the river and for turning basins authorized by the acts of June 13, 1902, and March 3, 1905, respectively. All the land for turning basin No. 1 has been acquired and the basin has been dredged. At the close of the year negotiations were well under way toward the acquisition of the necessary lands for turning basin No. 5 and it is expected that the deeds for the same will be tendered early in the coming year. It is reported that deeds will also be tendered for the lands necessary for widening the river between the "Forks" and the junction of the Little and Grand Calumet rivers, a distance of about 1.65 miles. Although Congress has authorized the Secretary of War to accept such deeds for lands above the Forks, no appropriation has been made for doing the work.

The right of the Sanitary District of Chicago to reverse the flow of Calumet River is still pending in the United States circuit court at Chicago.

The annual commerce has reached 6,000,000 tons, the principal items being iron ore, grain, and coal. It is steadily increasing, and new manufacturing plants are steadily occupying the river banks as fast as the 20-foot depths are carried upstream.

The existence of this improved river is considered to be of great use in controlling freight rates, and is claimed to save at least 50 cents per ton over Chicago River rates, and more over the usual Calumet (South Chicago) railroad rates.

It is proposed to apply the funds now available and those asked for for the year ending June 30, 1911, to continuing the enlargement of the channel progressively upstream according to the 1903 project, adopted by act of March 3, 1905, and to the construction of the turning basins authorized under such project, as soon as the land needed therefor be deeded to the United States, and for maintenance.

July 1, 1908, balance unexpended	$357,855.46
Amount appropriated by sundry civil act approved March 4, 1909	30,000.00
	387,855.46
June 30, 1909, amount expended during fiscal year, for works of improvement	83,107.02
July 1, 1909, balance unexpended	304,748.44
July 1, 1909, amount covered by uncompleted contracts	58,049.70
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K K 4.)

5. *Michigan City Harbor, Indiana.*—The inner and outer harbors were formerly separate works. They are now consolidated in consequence of the requirements of the river and harbor act of June 13, 1902.

Inner harbor.—This harbor has been under improvement by the United States since 1836, under a project to dredge the mouth of Trail Creek and to protect its entrance by piers about 100 feet apart. Between 1866 and 1882 the scope of the improvement was gradually enlarged so as to include dredging the creek 120 to 150 feet wide to the crossing of the Lake Erie and Western Railroad, a distance of nearly 2 miles from the entrance, and including two small turning basins, the banks being revetted by the local authorities or riparian owners. Proposed depth of navigation, 15 feet. By authority of the river and harbor act of March 3, 1905, a third turning basin was excavated at the lower bend of the inner harbor, at a cost of not exceeding $25,000.

Outer harbor.—Original project adopted in 1870, amended in 1880, 1882, and 1899; to construct a general harbor of refuge for vessels which may be exposed to storms in the southeastern portion of Lake Michigan. A revised project of 1899 contemplated the removal of the then existing outer western breakwater; the extension of the eastern harbor pier for a distance of 600 feet; the construction of a new detached breakwater, at first to be limited to a length of 1,500 feet, to protect the harbor from westerly storms; and the closing of the entrance to the outer harbor basin, involving the abandonment of the old pier and breakwater structures inclosing the basin on the north and east. Estimated cost of revised project of 1899, $282,150; amended in July, 1903, $312,150.

A good brief history of this river and harbor improvement is given on pages 678–680, Annual Report of the Chief of Engineers for 1908, and a very full description of present conditions is to be found on pages 169–170, Bulletin No. 18 (1908), issued by the United States Lake Survey office, Detroit, Mich.

By joint resolution of Congress approved May 13, 1908 (Public No. 23), the Secretary of War was authorized, in his discretion, to use any unexpended balance of money heretofore appropriated, or that may be hereafter appropriated for the improvement or maintenance of this harbor, for the rebuilding of the western revetment upon a new alignment, with the view of widening the channel.

In accordance with this authorization a new general project was approved by the War Department under date of August 15, 1908, and covers the following items of work:

Widening of inner harbor entrance (building of new pier, removal of old pier, and dredging between)	$72,000
Redredging of inner harbor channel	50,000
Original dredging, upper end of inner harbor	16,000
Completion of exterior breakwater	30,000
Repair, maintenance, and supervision	12,000
Total	180,000

The act of March 3, 1909, appropriated $49,500, which it was intended to apply on the items of approved project, but owing to the extensive damage done by the severe storms of last winter it was necessary to divert $39,500 of this amount toward necessary urgent repairs to the harbor structures and other items of maintenance. This sum of $39,500 so diverted should be replaced by future appropriations in addition to the usual $10,000 per annum required for maintenance. The district officer submitted an estimate amounting to $50,000 for repairs to the outer breakwater alone, rendered necessary by these storms, but a proper regard for other works throughout the country and the limited amount provided by the emergency clause of the act of March 3, 1909, made it inadvisable to allot more than $20,000 for this purpose.

There has been expended on previous projects $1,568,799.26, including $249,670.49 for maintenance; and on the present project (adopted in 1908) $12,947.37, all being for maintenance except $115.

The following work of maintenance was done during the year: Partial repairs were made to the piers and breakwaters; a thorough examination was made of the harbor structures, and contracts were entered into to repair some of the damage caused by the past winter's storms; the gap in the easterly harbor pier was deepened to 6½ feet; the entrance channel was redredged; a contract was entered into for the construction of a new westerly pier and for removal of old pier, but up to the close of the year little progress was made on this work. Negotiations were in progress with the authorities of Michigan City for the acquisition of the land needed for widening the entrance of the harbor, and the deeds therefor will probably be tendered early in the coming year.

All depths are referred to Chicago city datum (low water of 1847), which is 579.94 feet above New York mean tide. The early improvements at this place were referred to the zero of the Michigan City gauge, which is now found to be 581.64 feet above New York mean tide or 3.12 feet above standard low water of lake survey charts.

The head of navigation is at the upper turning basin, a distance of about 2 miles from the end of the westerly pier. The depths vary from 18 to 20 feet from the outer harbor entrance to Franklin Street Bridge; thence from 13 to 14 feet to Eighth street; thence 4 to 5 feet to upper turning basin.

The annual commerce is now reported as 33,448 tons and consists principally of lumber and salt and is steadily decreasing. The local commerce, consisting principally of package freight between Michigan City and Chicago, is steadily increasing, but no accurate record of this tonnage is kept. The passenger travel (summer excursion) is increasing rapidly. Information received as to the effect of the project on freight rates is meager, but indicates that in a general way the improvement has a tendency to reduce charges and secure advantageous charters for shippers. The city is growing rapidly and steadily.

The funds in hand and those asked for will be expended toward the completion of the approved project and for maintenance and contingencies.

July 1, 1908, balance unexpended		$79,464.51
Amount allotted from appropriation by river and harbor act approved March 3, 1909		49,500.00
Amount allotted from emergency appropriation, river and harbor act of March 3, 1909		20,000.00
		148,964.51
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$115.00	
For maintenance of improvement	12,832.37	
		12,947.37
July 1, 1909, balance unexpended		136,017.14

July 1, 1909, amount covered by uncompleted contracts	$93,300.46
Amount (estimated) required for completion of existing project	95,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1909	65,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K K 5.)

6. *Removing sunken vessels or craft obstructing or endangering navigation.*—(*a*) *Six wrecks of old vessels and scows in turning basin No. 1, Calumet River, Illinois, near Ninety-third street.*—Reported as dangerous to small-boat navigation in this part of the river; they were destroyed and the débris removed at a total cost to the United States of $2,887.50.

(*b*) *Schooner David Dows, 6¾ miles N. 70° 30′ E. from South Chicago breakwater light-house.*—Reported as a menace to navigation by United States Lake Survey office, Detroit, Mich. The wreck was destroyed and all débris removed to a least depth of 26½ feet below Chicago city datum at a total cost to the United States of $1,603.75.

(*c*) *Schooner S. A. Wood, in North Branch of Chicago River near Fullerton avenue.*—Reported as an obstruction to navigation by vessel owners; was destroyed and débris removed from the river channel at a total cost to the United States of $796.90.

(*d*) *Steamer Eagle, in North Branch of Chicago River near Division street.*—Abandoned by owners; was raised and then towed out to deep water in Lake Michigan, where it was burned and sunk at a total cost to the United States of $1,181.83.

(*e*) *Hydraulic dredge Illinois, in Lake Michigan, about 2 miles east of the foot of Thirty-first street, Chicago, Ill.*—Abandoned by owners; was destroyed and débris removed to a depth of about 27 feet below Chicago city datum at a total cost to the United States of $699.91.

EXAMINATION, WITH PLAN AND ESTIMATE OF COST OF IMPROVEMENT, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated November 14, 1907, August 28, 1908, and September 23, 1908, respectively, on preliminary examination, with plan and estimate of cost of improvement, of *Indiana Harbor, Indiana,* with a view to determining whether improvement of the harbor is advisable, required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1113, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $62,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND CHICAGO, ILLINOIS, DISTRICT.

This district was in the charge of Maj. C. S. Riché, Corps of Engineers. Division engineer, Col. W. L. Fisk, Corps of Engineers.

1. *Illinois River, Illinois.*—(*a*) *Below Copperas Creek.*—The project, which contemplates the extension of slack-water improvement begun

by the State of Illinois from Copperas Creek lock to the Mississippi River, and which includes the construction of two locks 350 feet long between sills, 75 feet width of chamber, with 7 feet of water over sills at low-water level of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water, was adopted in 1880.

The lock and dam at Kampsville, Ill., 31 miles above the mouth of Illinois River, has been completed and in use since 1894, and that at La Grange, 79 miles above the mouth, since 1890.

The State of Illinois, aided by the United States, has executed part of the general project by the construction of locks and dams at Henry and at Copperas Creek, completing, except dredging, that part of the project between La Salle and the mouth of Copperas Creek, a distance of about 90 miles, over which section the State of Illinois collects tolls.

Harbor lines on both sides of the river at Peoria have been established.

The United States has expended on this work to June 30, 1909, $1,539,805.93, of which $13,616.94 was expended during the fiscal year in maintenance of plant and rebuilding same, dredging, snagging, and supervision of the river and care of property and plant.

The improvement of Illinois River has been in progress many years, and the present navigable depth has obtained at ordinary stages of the river for several years, during which freight rates in the vicinity have decreased to some extent; but as freight rates generally have diminished during these years, it is impossible to state whether the effect of river competition is shown in diminished railroad freight rates. The closing of the river to navigation, however, would unquestionably lead to a rise in freight rates on the adjacent railways, and as the volume of freight affected would be large, a good navigable condition should be maintained.

There are many wagon bridges and railroad bridges across the river, and at Peoria the troughs of large distilleries discharge into the channel; these structures have been modified from time to time to meet the demands of navigation.

It is proposed to apply the available fund and the appropriation recommended toward maintaining the navigable channel of 7 feet depth, removing snags, dredging, care and repair and rebuilding plant, and such local surveys as may be necessary from time to time.

July 1, 1908, balance unexpended		$60,728.32
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$10,000.00	
For maintenance of improvement	3,616.94	
		13,616.94
July 1, 1909, balance unexpended		47,111.38
July 1, 1909, outstanding liabilities		500.00
July 1, 1909, balance available		46,611.38
Amount (estimated) required for completion of existing project		142,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		50,000.000

(*b*) *From Copperas Creek to La Salle.*—The first appropriation for this section of the river was made March 2, 1907, and the approved project for its expenditure provides for securing the same navigable conditions from Copperas Creek to La Salle as are planned for the lower river, i. e., a channel depth of 7 feet at low water.

Operations have consisted in snagging, supervision, and repairs and additions to plant for dredging purposes; surveys have been made to locate shoal points and bars. The stage of water has been too high to render dredging either practicable or necessary. Work on this section of the river is to be carried on with the same plant used on the lower section.

The amount expended on this work to June 30, 1909, is $12,997.41, of which $4,604.67 was expended during the fiscal year.

It is proposed to apply the available funds to securing and maintaining a navigable channel of 7 feet depth, snagging, care, and repair of property and plant, inspection and prevention of obstructions and encroachments, and such local surveys as may be necessary.

July 1, 1908, balance unexpended	$41,607.26
June 30, 1909, amount expended during fiscal year, for works of improvement	4,604.67
July 1, 1909, balance unexpended	37,002.59
July 1, 1909, outstanding liabilities	300.00
July 1, 1909, balance available	36,702.59

(See Appendix L L 1.)

2. *Operating and care of La Grange and Kampsville locks, Illinois River, and approaches thereto.*—These locks and dams have been maintained and operated under the indefinite appropriation provided for in section 4 of the river and harbor act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

(*a*) *La Grange lock and dam.*—This lock was open to navigation the entire year except three weeks in January and two weeks in February. There was expended during the fiscal year $6,892.17.

(*b*) *Kampsville lock and dam.*—The lock was open to navigation the entire year except three weeks in January and nine days in February. The lock gates have been rebuilt. The number of boats passing the lock shows an increase during the year. There was expended during the fiscal year $6,652.42.

(See Appendix L L 2.)

3. *Illinois and Mississippi Canal, Illinois.*—The object of the improvement is to furnish a link in a navigable waterway from Lake Michigan to the Mississippi River at the mouth of Rock River, Illinois.

The canal has been located on the Rock Island route, approved by the Secretary of War October 27, 1888, as directed in the act of Congress of August 11, 1888. It proceeds from the Illinois River at its great bend, 1¾ miles above the town of Hennepin, Ill.; thence via Bureau Creek Valley and over the summit to Rock River at the mouth of Green River; thence by slack water in Rock River and a canal around the lower rapids of the river at Milan to the Mississippi River at the mouth of Rock River.

The canal is to be at least 80 feet wide at the water surface, 7 feet deep, and with locks 170 feet long and 35 feet width of lock chamber, capable of passing barges carrying 600 tons (maximum) freight.

A report upon the location, with detailed estimate of cost, of this canal was submitted June 21, 1890, and is printed in the Annual Report of the Chief of Engineers for 1890, page 2586.

The river and harbor act of September 19, 1890, made the first appropriation for the construction of the canal, and directed work to be begun by the construction of one of the locks and dams in Rock River.

In accordance with this act work was begun in July, 1892, near the mouth of Rock River, on the construction of a canal around the lower rapids of the river, and since that date has been prosecuted as rapidly as the appropriation of funds permitted.

The river and harbor act of March 3, 1905, authorizes the Secretary of War, in his discretion, to construct a fixed dam with movable crest in Rock River, in lieu of the lock and dam at or near Sterling, Ill., provided for by the approved project, the said dam with movable crest to be built from funds already appropriated or authorized for the construction of the canal and to constitute a part of the project for its construction.

The river and harbor act of June 3, 1896, placed the work under the continuing-contract system and limited the average amount of contract liability to be incurred in any one fiscal year to $400,000. There has been expended on this work to the close of the fiscal year ending June 30, 1909, $7,401,100.78.

The result of this expenditure has been:

First. The acquisition of the right of way for 4½ miles around the lower rapids of Rock River and the completion of 4½ miles of canal there, involving the construction of 4½ miles of earthwork, 3 locks, 1 railroad and 2 highway swing bridges, 7 sluiceways and gates, 1 arch culvert, 2 dams 1,392 feet long across the arms of Rock River, 3 lockkeepers' houses, 1 small office building, a thorough riprapping of the canal banks (not included in the original estimates), and construction by contract of Moline wagon bridge, at a cost of $25,000, which was also not included in the original estimate.

Second. The acquisition of right of way for the main line and navigable feeder, completion of all railway and highway bridges, locks, culverts, aqueducts; execution of all earthwork and completion of dam and controlling works at head of feeder; construction of houses for lockmen, overseers, and superintendent; and part of the necessary blasting and dredging in Rock River pool.

The canal was filled with water and formally opened to navigation October 24, 1907. Operating force has been organized and since January 1, 1908, the work has been maintained under the indefinite appropriation for operating and care of canals and other works of navigation, the completion of construction work progressing at the same time.

The entire work embraced in the original project for the canal, as modified by subsequent projects and plans as the work has progressed, may be summarized as follows:

Surveys and location upon the ground.
Acquisition of right of way and fencing.
Construction of—
    95.8 miles of earthwork.
    67 highway bridges.

Construction of—Continued.
  1 farm bridge.
  3 ponton bridges.
  8 railroad bridges.
  9 aqueducts.
  62 culverts.
  33 locks.
  9 sluiceways and gates.
  3 dams.
  46 houses.
  Outlet to Rock River.
  New highway on mile 16.
  Improvement of 8.5 miles of Rock River.
  Moline wagon bridge (not in original estimate).

The work thus far completed may be summarized as follows:

Surveys and location upon the ground.
Acquisition of right of way and fencing.
Construction of—
  95.8 miles of earthwork.
  67 highway bridges.
  1 farm bridge.
  8 railroad bridges.
  9 aqueducts.
  62 culverts.
  33 locks.
  34 sluice gates.
  3 dams.
  45 houses and part of 1 additional.
  New highway on mile 16.
  Moline wagon bridge.
  1 ponton bridge
  Part of dredging in Rock River.
  Emergency gates, mile 23.

Miscellaneous work of revetting, grading, making towpath, ditching, planting trees, etc.—The work remaining to be done consists of blasting and dredging in Rock River pool, completing houses, grading, strengthening banks, and miscellaneous items of finishing.

July 1, 1908, balance unexpended	$178,763.18
Amount received during year	[a] 3,534.80
	182,297.98
June 30, 1909, amount expended during fiscal year, for works of improvement	81,537.39
July 1, 1909, balance unexpended	100,760.59
July 1, 1909, outstanding liabilities	3,000.00
July 1, 1909, balance available	97,760.59
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	125,000.00

(See Appendix L L 3.)

4. *Operating and care of Illinois and Mississippi Canal.*—This canal was formally opened to navigation October 24, 1907, and since January 1, 1908, has been maintained under the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

---

[a] Judgment in case Cogan & Pound, $3,000; sale of scrap iron, etc., $534.80.

Work has consisted in organizing forces, patrolling banks, repairing and ditching, operating locks, maintaining and repairing structures, rebuilding telephone line, building barges, maintaining and operating boats, remedying seepage conditions, removing sediment and deposits, clearing débris, testing, seeding, and revetting banks, installing telephone system, and repairing breaks. Rules and regulations for the operation of the canal were approved by the Secretary of War April 8, 1908. Several leases have been made with private parties for tracts on the right of way for commercial purposes.

It is too early to predict what the character or amount of commerce on the canal will be, or what its effect upon freight rates will be. The section traversed is an agricultural country of great fertility and well developed, with many and various manufacturing interests of moderate size in the adjacent territory. The effect upon freight rates which was hoped for from this canal when it was projected eighteen years ago has been largely realized from other causes, among which competition among railroads and larger train loads may be mentioned.

There was expended on this work during the fiscal year the sum of $170,398.93, exclusive of $5,284.22 outstanding liabilities June 30, 1909.

(See Appendix L L 4.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE GRAND RAPIDS, MICHIGAN, DISTRICT.

This district was in the charge of Col. M. B. Adams, Corps of Engineers, to March 1, 1909, and of Maj. Charles Keller, Corps of Engineers, since that date. Division engineer, Col. W. L. Fisk, Corps of Engineers.

General statement as to the usual variations in the level of the lake surface at all the harbors on the eastern shore of Lake Michigan.—The level of the lake surface varies considerably from time to time. At present its highest stage may be stated as about mean lake level, and obtains from the end of June to the middle of August. Its lowest stage is between 1.5 and 2 feet below mean lake level, and obtains with slight change from early in November to early in April. All depths at the various harbors in this report are referred to zero of gauge, which is 581.63 feet above mean tide at New York, and is the mean lake level above mentioned.

1. St. Joseph Harbor and River, Michigan.—These were formerly carried as separate works, but are now combined in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *St. Joseph Harbor.*—This harbor is formed by the junction of the St. Joseph and Pawpaw rivers and extends along the city front of St. Joseph, and in its original condition had a natural width of 800 feet, which has been reduced to 300 feet by wharves built upon the approved harbor lines. It has been under improvement by the United States since 1836, previous to which time there was a narrow and crooked channel with depths which varied from 3 to 7 feet. The original project of 1836 is not clearly known. Up to 1866 there were built 1,100 feet of north pier and 212 feet of south pier, which protected a cut through the narrow tongue of land to the north of the old river mouth, the width between the piers being 240 feet, which became 257 feet through subsequent repairs. In all, $162,113 was expended upon this work. In 1866 the first definitely known project was adopted, and this proposed the extension of the south pier 200 feet for the purpose of facilitating the creation of a direct channel of 16 feet depth through the bar at the entrance. The project of 1866 was modified in 1874, 1875, 1880, and 1892, the changes having reference principally to the length and direction of the two piers. The Benton Harbor Canal, which is about 1 mile long and extends from the upper part of the harbor to the town of Benton Harbor, was taken over by the United States for the purpose of care, maintenance, and improvement in 1880. In all, there was expended upon these various projects $503,113.23.

The river and harbor act of March 3, 1899, adopted the present project, which is printed in the Annual Report of the Chief of Engineers for 1898, pages 2496-2498. This project provides for an entrance channel 18 feet deep and for an interior channel 18 feet deep and 150 feet wide along the city front of St. Joseph, while the Benton Harbor Canal and the turning basin at the mouth of the St. Joseph River were to be dredged to 15 feet, the north pier extended 1,000 feet, and the south pier, upon a line parallel with the north pier, 1,800 feet. The width was to be 330 feet at the entrance, narrowing to 257 feet inside. The estimated cost of completion of the existing project was given in the above report at $380,000.

Up to June 30, 1909, there has been expended upon the existing project $372,175.51, of which $69,082.13 was applied to maintenance.

The operations during the fiscal year were all for maintenance, and have been as follows: The channel between the piers and in the interior harbor to the mouth of the Morrison channel was dredged to a depth of 18 to 20 feet. Repairs were made to damaged portions of the entrance piers, and 388.73 cords stone were placed in parts of the piers where the filling was deficient. Great deficiencies of filling still exist, and an arrangement for the delivery of about 830 cords additional stone has been made, the work to be done in the next fiscal year.

All new construction work and dredging to the proposed depth and width under the approved project have been completed, and present operations are confined to maintenance.

The north pier and revetments measure 2,854 feet, 2,183.5 feet being cribwork and 670.5 feet pile work. At the east end a wing 165 feet long connects it with the dock of the United States light-house depot. The south pier is 2,623 feet long, 1,800 feet being cribwork and 820 feet pile work. These structures are in fair condition, except the 165 feet of wing at east end of north pier. Minor repairs to decking and additional stone filling are needed.

The completion of the approved project has resulted in a through channel of largely increased width, depth, and general availability. The channel is, however, subject to deterioration due to sand brought down by the St. Joseph and Paw Paw rivers during the annual floods, and has required and will continue to require repeated dredging for its maintenance. The available depths on April 26, 1909, were as follows: In the outer approach, 22 feet; between the piers, 19.7 feet;

in interior harbor from entrance piers to mouth of Benton Harbor Canal, 18 feet; and in Benton Harbor Canal, 15 feet.

The lake commerce during 1908 amounted to 145,913 short tons, valued at $23,883,000, and was principally local in character. The total number of passengers carried was 221,275, and the number of entrances and clearances 1,265.

The principal traffic benefited by this improvement is the transportation of manufactured products, the fruit traffic, and the carrying of passengers, including excursionists. All classes of traffic show continuous growth. One line of steamers, during the summer, runs from two to four boats daily, some of these being of great size, and another line makes daily trips across the lake. The freight rates to Chicago by rail are in about the proportion of 3:2 as compared with vessel rates.

The available balance of funds is sufficient for the probable amount of required dredging and for the maintenance of the works in serviceable condition until June 30, 1911, and therefore no estimate for additional funds is presented.

House Document No. 307, Fifty-fifth Congress, second session, reproduces a map accompanying the present revised project, which is not republished in the Annual Report of the Chief of Engineers for 1898.

(*b*) *St. Joseph River.*—This is a crooked stream, obstructed by numerous shoals, with depth in channel crossings of from 24 to 30 inches. The intervening pools are generally from 4 to 8 feet deep. The part under improvement is from the mouth at St. Joseph to Berrien Springs, a distance of about 22 miles by river. The improvement of this section to make a low-water channel 3 feet deep has been in progress since 1889, and consists in removing snags and logs and closing secondary channels, and in concentrating the flow at critical points by dams of brush, logs, and stone.

The amount expended to June 30, 1909, was $6,246.26, of which $4,555.49 was for construction and $1,690.77 for maintenance, as a result of which many of the worst places of the stream had been improved to the required extent.

Operations on the St. Joseph River usually comprise a small amount of wing-dam construction, and the removal of overhanging trees and snags by a force of hired laborers; no work was done on this river during the past year, and inquiry from interested parties failed to elicit the necessity for any. No appropriation is asked for improvement, as the funds on hand are believed to be sufficient for the next two years' operations.

The traffic benefited by this improvement is a limited one, two small steamers being employed to carry passengers (almost exclusively summer tourists). No freight was carried in 1908. The number of passengers carried in 1908 was 19,812.

The money on hand will be expended in maintenance and contingencies.

The effect of the improvement on freight rates is probably, during the season of navigation, to cause a reduction of at least one-third.

ST. JOSEPH HARBOR.

July 1, 1908, balance unexpended	$21,928.74
Proceeds of sale of government property	65.85
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	36,994.59
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	7,877.63
July 1, 1909, balance unexpended	29,116.96

SAINT JOSEPH RIVER.

July 1, 1908, balance unexpended	$1,003.74
July 1, 1909, balance unexpended	1,003.74

CONSOLIDATED.

July 1, 1908, balance unexpended	$22,932.48
Proceeds of sale of government property	65.85
Amount allotted from appropriation by river and harbor act approved March 3, 1909	15,000.00
	37,998.33
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	7,877.63
July 1, 1909, balance unexpended	30,120.70

(See Appendix M M 1.)

2. *South Haven Harbor, Michigan.*—This harbor is situated at the mouth of Black River. Improvements were begun in 1867, at which time there existed a channel 7 feet deep and 85 feet wide between slab piers. These piers had been built by residents of the vicinity, at a cost of about $18,000. The banks of the river for 500 feet on each side had a rough protection of close piling.

The project of 1866, as modified in 1869, 1872, and 1888, provided for constructing parallel piers and revetments 175 feet apart at the mouth of Black River, with the object of procuring a channel 12 feet deep and extending the navigable channel one-half mile up Black River to the highway bridge by dredging.

The act approved March 3, 1905, adopted a project for pier extension and dredging to a depth of 16 feet, at an estimated cost of $279,370, and $10,000 annually for maintenance. (See H. Doc. No. 119, 58th Cong., 2d sess.) The law provided, however, that none of the $50,000 appropriated for the improvement should be used, except for maintenance of existing channels, until proper dock lines had been established and suitable bulkheads built along these lines by the city of South Haven or by the riparian owners, and the property lying on the channel side of these dock lines had been deeded to the United States free of cost.

By joint resolution of Congress approved June 29, 1906, $10,000 of the appropriation of March 3, 1905, was made immediately available to afford a 16-foot depth in the channel. This sum was expended prior to June 30, 1907.

The act of March 2, 1907, appropriated $40,000 for this harbor, subject to restrictions similar to those imposed by the act of 1905.

Unless the conditions precedent to the expenditure of the appropriations, March 3, 1905, and March 2, 1907, are complied with, further operations must be restricted to maintenance of a 12-foot channel, under the project of 1888, which, except for maintenance, has been completed. Owing, however, to the possibility of one or more of the riparian owners at the inner ends of the government piers complying with the prescribed conditions, it is proposed to maintain a channel depth of 16 feet between the piers and 18 feet over the outer bar, so that the requirements of the act of March 2, 1907, on the Government's part may be complied with immediately when such riparian owners have met the requirements of the law on their part.

The total expenditure to June 30, 1909, was $350,739.35, of which $187,253.08 was expended for construction and $163,486.27 for maintenance. This expenditure includes the $10,000 made available by joint resolution of Congress of June 29, 1906, but may otherwise be properly assigned to the original project and its modifications, work under the project of March 3, 1905, not yet having been commenced.

The operations during the fiscal year were confined to completing the dredging in the lower channel by the U. S. dredge *Gillespie,* begun May 26, 1908. The work resulted in temporarily providing a depth of 16 to 17 feet between the piers and of 18 to 20 feet outside of the entrance. A contract was entered into March 27, 1909, for placing additional stone in parts of the piers, where the filling is deficient, but no work has yet been done.

For reasons stated, no work has yet been done upon the present project. The available depths on April 14–15, 1909, when soundings were made, were 15.4 feet in front of the entrance and 14.6 feet between the piers and in the interior channel. Dredging for the restoration of the needed width and depth of channel at the entrance and inside will be begun early in July, 1909.

The water-borne commerce at this port is practically all local in character. In 1908 there were 466 entrances and clearances with 18,765 short tons of cargo, with an estimated value of $4,423,000.

The project of 1888, restricting, as it does, the draft of vessels to 12 feet, imposes such limitations upon their size that the improvement has to-day a diminished effect on freight rates. Until a uniform depth of 16 feet has been made available, the use of the harbor will be confined largely to passenger vessels carrying in addition small quantities of perishable freight, such as fruit. Even in its present unsatisfactory condition, vessel freight rates to and from Chicago are 13 per cent less than the corresponding railroad rates.

The money on hand will be sufficient for the maintenance of the improvement, and accordingly no additional appropriation for that purpose will be needed for the year ending June 30, 1911, if only the project depth of 12 feet in the inner harbor is to be maintained. Should the conditions imposed by the river and harbor acts of March 3, 1905, and March 2, 1907, be complied with by local interests, however, the sum of $153,707, in addition to the funds now available, could be profitably expended in the fiscal year ending June 30, 1911, in prosecutions of the 16-foot project provisionally adopted by said acts.

The Annual Report of the Chief of Engineers for 1904, pages 3056–3069, and House Document No. 119, Fifty-eighth Congress, second session, contain in full the report relating to the existing project. A map of the harbor is attached to the House document.

July 1, 1908, balance unexpended	$63, 126. 89
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	[a] 4, 428. 77
July 1, 1909, balance unexpended	58, 698. 12
July 1, 1909, outstanding liabilities	898. 04
July 1, 1909, balance available	57, 800. 08
July 1, 1909, amount covered by uncompleted contracts	3, 598. 95
Amount (estimated) required for completion of existing project	248, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	[b] 153, 707. 00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix M M 2.)

3. *Harbor at Saugatuck, and Kalamazoo River, Michigan.*—Before the work of improvement was begun by the United States, in 1869, this harbor, which is at the mouth of Kalamazoo River, had been improved by local enterprise by the construction of slab piers 200 feet apart, the north pier being 500 feet long and the south pier 1,575 feet. The channel depth varied from 5 to 7 feet. The present project for the old harbor at the mouth of the river was adopted in 1867 and amended in 1869, 1875, and 1882. At the old harbor there is a north pier 715 feet long, which is entirely unserviceable; separated from the pier by a long stretch of unprotected bank there is a north revetment, partly destroyed and partly covered by sand. The south pier is 3,863 feet long and is practically ruined. Frequent dredging was required for maintenance of an 8-foot channel. Appropriations after 1882 were too small to keep the piers in proper repair. To June 30, 1906, $207,785.92 had been expended, of which $90,231.99 was for construction and $117,553.93 for maintenance, and as no further expenditures will be made on old harbor, the balance unexpended July 1, 1906, $9,453.08, was diverted to improvement of new harbor.

The existing project for the new harbor was adopted by the river and harbor act of June 3, 1896. It provides for creating a channel of 12 feet depth and navigable width by dredging the river for a distance of 1¾ miles below Saugatuck, and thence making a new cut from the river to the lake, entering the latter about 3,700 feet north of the original mouth at the old piers. The original estimate for the work was $150,000, but authority was granted on May 31, 1900, to increase this to $250,000. The river and harbor act of March 2, 1907, authorized the maintenance of a harbor channel of sufficient depth to allow the free use of the government dredge *General Gillespie*, viz, 16 feet.

---

[a] Exclusive of $2.83, refundment of overpayment, which has been deducted from expenditures during the fiscal year.

[b] As explained in the text of the report, this estimate is recommended only upon compliance by local interests with the conditions imposed by the acts of March 3, 1905, and March 2, 1907.

To June 30, 1909, $273,783.23 had been expended under the existing project—$233,403.75 for construction and $40,379.48 for maintenance.

During the fiscal year ending June 30, 1909, the following work was done (at a total cost of $22,670.27): The stone filling in the outer 700 feet of each pier was brought to the level of +3 feet by the addition of 411.1 cords stone, and under the head of maintenance the following work was done: By contract dredging between July 2 and August 29, 1908, the channel outside of the entrance and between the piers was dredged for a width of 60 feet to a depth of 16 feet, and the government dredge was employed from September 5 to October 29 in increasing the width. At the end of that time the available depth outside and between the outer piers was 16 feet and between the revetments inside 15.2 feet. The plank walk on the projecting piers was repaired, and a communication between the lake and the river behind the south pier was closed with a dam of sand. The available depths found April 9, 1909, were 15.6 to 17.1 feet in front of the entrance, 13 feet between the piers, and 12.2 feet in the river in a narrow channel. Dredging for widening the channel was begun June 29, 1909.

The works provided for by the approved project have been completed, and further operations will be confined to maintenance. The maximum draft that could be carried June 30, 1909, was 12.2 feet.

The harbor is near a very prosperous fruit region, and the fruit traffic has been its principal source of business. Saugatuck is but 8 miles south of Holland, with which it is now connected by a trolley road, and about 17 miles north of South Haven. Holland and South Haven both command other sources of business than the fruit traffic, and bid fair to increase in importance through the fact that they are termini of railroad lines.

The vessel freight at this harbor for the calendar year 1908 was 4,885 short tons, valued at $342,000, and was entirely local in character. The number of passengers carried was 4,636 and the total number of vessels arriving and departing was 662.

It is reported that as yet the project has had no effect on freight rates.

The money on hand will be expended in maintenance and contingencies. Some dredging in the inner channel will unquestionably be required before June 30, 1911, and it is estimated that an appropriation of $15,000 will be needed to cover this work.

The Annual Report of the Chief of Engineers for 1896, pages 2741–2743, and House Document No. 192, Fifty-fourth Congress, first session, contain in full the report pertaining to the adopted project for the proposed change in the location of this harbor. The House document contains also a map of the locality.

The act of Congress approved March 3, 1909, provides for making a preliminary examination of "Saugatuck Harbor and Kalamazoo River, with a view to securing increased depth to the town of Douglas." The examination has been made, and the report thereon will be submitted to Congress at its next session.

July 1, 1908, balance unexpended		$23,040.17
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		33,040.17
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$5,843.20	
For maintenance of improvement	16,827.07	
		22,670.27
July 1, 1909, balance unexpended		10,369.90
July 1, 1909, outstanding liabilities		10.15
July 1, 1909, balance available		10,359.75
July 1, 1909, amount covered by uncompleted contracts		5,156.25
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix M M 3.)

4. Holland Harbor, Michigan.—When improvement was begun in August, 1867, by the United States there existed a narrow channel 5½ feet deep between piers built of brush and of irregular cribs. These had been constructed by the harbor commissioners of the adjoining town of Holland.

A project was adopted in 1867 and amended in 1873, 1879, 1884, and 1892, this project providing in general terms for a channel 12 feet deep between piers and revetments 160 feet to 213 feet apart. From 1867 to 1880 there were built by the United States piers and revetments aggregating 1,854 feet on the north side and 1,691 feet on the south side. Since the latter date there have been no additions to these structures, except, in 1889, a length of 160 feet of pile pier on the south side, designed to close a gap in the existing structure. Upon this project there was expended up to March 3, 1899, $304,217.30, of which $127,597.50 was for maintenance. The end cribs of the piers were wrecked by storms and they were removed in September, 1908. As a result, the length of the north pier at present is 1,808 feet and that of the south pier 1,639 feet.

The present project was adopted in 1905 and modified in 1907. It provides for a channel 16 feet deep, protected on the outside by two converging piers 300 feet apart at the outer end and 740 feet apart at the inner end, and on the inside by piers and revetments having a clear distance of about 205 feet at the outer end and of 162 feet at the narrowest place inside, the inner ends of the converging portions to be connected with the old piers of the inner channel by stone-filled pile structures. The project also provided for extensive repairs of the existing works. The estimated cost was $240,000.

From March 3, 1899, the date of adoption, to June 30, 1909, there was expended on this project and its modifications $381,932.08, of which $93,799.71[a] was for maintenance.

---

[a] $16,422.19 erroneously reported as expended for maintenance instead of for construction in 1908 report has been corrected in 1909 report by reducing the total cost of maintenance the above amount.

The operations during the fiscal year were as follows: Under the continuing contract of October 11, 1905, the construction of the two converging pier extensions, 750 feet in length on the north side and 800 feet on the south side, was completed, as also the connecting pile structures at their inner ends, with the exception of a small amount of stone filling. The reconstruction of the interior north pier from the shore line to the angle and the repairs of the south pier from the shore line to the inner end were also completed, and the repairs of about 340 feet of the outer portion of the interior south pier are fairly well advanced. All the above comes under the head of new work under the present project. Under the head of maintenance, the wrecked cribs at the outer end of the interior piers were removed and the new ends of the piers were strengthened and protected with round piles, connected by means of wales and screw bolts with the main structures. The channel at the entrance and between the interior piers to Black Lake was dredged July 29–31, September 21–23, November 24 to December 31, and again March 19 to April 26, the total quantity of material removed measuring 99,846 cubic yards. All the funds required for the completion of the continuing contract have been appropriated.

The approved project was very nearly completed on June 30, 1909.

The uncompleted condition of the piers and revetments has heretofore interfered seriously with the maintenance of the required depth, but better results may be expected hereafter. The maximum draft upon the completion of dredging in April was 18.4 feet, and at the end of the fiscal year 17 feet.

This harbor is relatively an important one, being the terminus of one of the lines of and one of the principal stations of the main line of the Pere Marquette Railroad Company and the terminus of the Grand Rapids, Holland and Chicago Electric Railway, which here connect with a line of steamers. These during the season of navigation, when the condition of the harbor permits, run regularly to Chicago. The passenger business is especially important, but there is also profitable freight traffic.

The vessel freight of this harbor has increased from 678 arrivals and departures, with 16,430 short tons, in 1903, to 830 arrivals and departures, with 165,155 short tons, valued at $53,480,000, in 1908. The total number of passengers carried in 1908 was 86,700. The commerce at this port is both general and local. Vessel freight rates to and from Chicago are about 14 per cent less than the corresponding railroad rates.

The balance available after paying all contract liabilities and contingencies will be about $30,000, of which $14,000 should be reserved for maintenance by dredging and general repairs until June 30, 1911. Past experience has shown that the converging or outer portions of the piers are liable to damage by storms, and that precautions should be taken to insure a permanent supply of riprap along them. Originally these piers were protected with about 2,000 cords of riprap, which was specified to weigh not less than 500 pounds, and presumably it weighed little more than this. For effective protection riprap should weigh from three to ten tons, and will then be correspondingly more difficult and expensive to place. Assuming that 2,000 cords of additional riprap may be needed, this will probably cost close to $20 per cord, or $40,000 in all, and therefore an additional appropriation of $24,000 is estimated as needed for the fiscal year ending June 30, 1911, to be charged to maintenance.

The report upon which the present project is based is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2950, 2951; and the Annual Report for 1905, pages 2176, 2177, contains a drawing and description of the adopted plan.

Information as to the effect of the improvement on freight rates is difficult to obtain, but it is certainly not less than a reduction of 14 per cent, and may be more than this.

July 1, 1908, balance unexpended		$173,102.89
June 30, 1909, amount expended during fiscal year:		
For works of improvement	[a]$100,796.24	
For maintenance of improvement	14,589.91	
		115,386.15
July 1, 1909, balance unexpended		57,716.74
July 1, 1909, outstanding liabilities		754.67
July 1, 1909, balance available		56,962.07
July 1, 1909, amount covered by uncompleted contracts		25,080.10
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		24,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix M M 4.)

5. Grand Haven Harbor, Michigan.—This harbor is at the mouth of Grand River, the largest river in the State of Michigan. Before any work had been done the natural depth at the mouth of the river varied from 9 to 12 feet, with greater depths in the inner reaches.

In 1857 the Detroit and Milwaukee Railroad Company (Grand Trunk), whose western terminus is at the town of Grand Haven, built a pile pier 3,185 feet long upon the south side of the entrance, and also revetted, by means of close piles, portions of the bank upon the north side of the river. In 1866, when work by the United States was begun, the pile pier had been partly destroyed by fire and by storms. The available depth was 13 feet.

The present project was adopted in 1866 and amended in 1868, 1880, 1890, and 1892. It provides for the construction of parallel piers and revetments 400 feet apart, with the object of creating an entrance channel 18 feet deep at an estimated cost of $804,366.15. The amendments to the original project did not materially change its original purpose, the changes being principally in the proposed length of the piers and revetments.

To June 30, 1909, there had been expended upon the existing project the sum of $881,068.12, of which $542,976.82 was for construction and $338,091.30 for maintenance.

Operations during the fiscal year have been for maintenance. The south pier between stations 7 + 07 E and 6 + 04 W was substantially repaired by contract, the work being completed June 25. Some minor repairs by day labor were made to damaged portions of the two piers. Under an emergency contract, work on refilling with stone parts of the two piers and riprapping the interior portion of the south revetment was begun in November and will be completed in July, 1909. From October 19 to 22, December 14 to 17, and again January 18 to 28, the government dredge deepened the channel across the outer bar and also widened the river channel opposite the Grand Trunk Railway dock, removing a total of 34,221 cubic yards of sand.

---

[a] Exclusive of $5.83, refundment of overpayment, which has been deducted from expenditures during the fiscal year.

The proportion of the approved project completed to June 30, 1909, is 93 per cent, the linear extent of the structures so far built being 3,538 feet in the north pier and 5,774 feet in the south pier. The available depths on June 12–19 were 18.9 feet in front of and 21.6 feet in the southern approach to the entrance outside, 18.6 feet between the outer end of the piers and 20 feet inside.

Even when there is no extraordinary freshet in Grand River, a central bar persists in forming from year to year beyond the entrance to this fine harbor and seriously impairs its usefulness. Consequently it is fortunate that there is a government dredge at hand to promptly furnish relief at any time.

In order to complete the project 250 feet of pier extensions are required at an estimated cost of $40,000.

This harbor has for years been one of considerable importance. It is the western terminus of the Detroit, Grand Haven and Milwaukee branch of the Grand Trunk Railroad, in connection with which is run throughout the year two lines of steamers to Milwaukee. In addition there is one line with regular and frequent scheduled trips to Chicago. All three lines do a large passenger and a very considerable freight business, especially during the season of fair weather.

The water-borne commerce at this port is mostly general in character, and has increased from 1,151 arrivals and departures with 155,854 short tons in 1900, to 1,538 arrivals and departures with 437,625 short tons of cargo, valued at $60,670,000, in 1908. The local freight rates from Grand Haven to Chicago by vessel are about 14 per cent lower than the corresponding rates by railroad.

Of the available balance $12,000 should be reserved for dredging by the *Gillespie* in 1909, 1910, and 1911, leaving about $115,000 available for repairing portions of the two piers, which are in very bad condition. The cost of completing this repair work was estimated, on page 2043 of the Annual Report of the Chief of Engineers for 1908, at $168,000. This harbor is one of considerable importance and the structures should be made thoroughly safe. Accordingly it is estimated that the difference between the amount now available for repairs and the above estimated total cost, namely, $53,000, should be appropriated for the fiscal year ending June 30, 1911. No estimate is submitted for pier extension, as at present it does not appear to be necessary, and by proper use of the dredge *Gillespie* may perhaps be avoided altogether.

The latest map of this harbor is found in the Annual Report of the Chief of Engineers for 1890, page 2650.

The effect of the project on freight rates is at least the reduction of 14 per cent noted above.

Report upon a preliminary examination of "Grand Haven Harbor to east end of Fulton street, and including channel into Spring Lake" was made by the district officer under date of May 31, 1909, in accordance with the requirements of the act of Congress approved March 3, 1909. This report will be submitted to Congress at its next session.

July 1, 1908, balance unexpended	$69,018.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	100,000.00
	169,018.80
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	[a] 25,143.85
July 1, 1909, balance unexpended	143,874.95
July 1, 1909, outstanding liabilities	162.15
July 1, 1909, balance available	143,712.80
July 1, 1909, amount covered by uncompleted contracts	14,480.53
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	53,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M M 5.)

6. Grand River, Michigan.—Before any work of improvement was done upon this stream the depth in the crossings over some of the bars did not exceed 2 feet.

Between 1881 and 1886 the sum of $50,000 was expended in securing, by dredging, narrow channels through these bars with a depth of about 4 feet. No further work was done until 1896, but even then, at the expiration of over ten years, traces of the dredged cuts were still apparent.

The former project, upon which work was begun in May, 1897, was adopted by the river and harbor act of June 3, 1896, and is based upon a report upon examination and survey reprinted in Annual Report of the Chief of Engineers for 1892, pages 2369 to 2395. The project contemplated dredging a channel a distance of 38 miles from Grand Haven to Grand Rapids, with a depth of 10 feet and a width of 100 feet. The project also proposes the use of contraction works wherever necessary to increase the effect of the dredging or to render it more permanent.

The original estimated cost of project adopted in 1896 was $670,500; but the project may be said to have been modified by act of June 13, 1902, and the cost increased to not less than $774,000.

The act of March 3, 1905, modified the former project by adopting the report submitted in House Document No. 216, Fifty-eighth Congress, second session, and by providing that no portion of the money appropriated shall be used in providing a turning basin in the city of Grand Rapids.

The report referred to above recommends, on pages 4 and 5, that a channel of 6 feet depth and 100 feet width be adopted for the improvement. The estimate in the report for a 6-foot channel 100 feet wide from Fulton street, in Grand Rapids, to Grand Haven, Mich., prepared from data furnished by the district officer, is $327,000 in addition to available plant and funds. This, together with the sum of $171,791.40 already expended toward the completion of a 6-foot channel, makes the total estimated cost of the existing project $601,791.40.

---

[a] Exclusive of $2.66, refundment of overpayment, which has been deducted from expenditures during the fiscal year.

To June 30, 1909, the sum of $421,500.66 had been expended in dredging 2,648,293 cubic yards of sand, clay, cobblestones, etc., in building 132,625 linear feet of training walls, and in the purchase and maintenance of plant. This sum includes $32,459.85 expended for maintenance of contraction works and $15,177.57 for maintenance of completed 6-foot channel.

All work upon the river is carried on by use of a plant belonging to the United States operated by hired labor. During the year operations have included widening the channel above the Lake Shore and Michigan Southern Railway bridge and, with the exception of two stretches aggregating a total length of 1,650 feet in which the depth is 6 feet and the width is 40 to 100 feet, its completion below that bridge. In addition the usual work of maintenance and repair of channel structures and plant has been continued.

The approved project has been practically completed and recent work has been mainly redredging, i. e., maintenance.

The available depths a year ago were stated as follows: Between Grand Rapids and the mouth of Bass River there is a navigable channel (in one short stretch of about 100 feet only the width of a single dredged cut) with the following depths at extreme low water: For about 21.1 miles, 6 feet; 1.5 miles, 5 to 6 feet; 0.8 mile, less than 5 feet. At the present time there is a navigable channel from Grand Rapids to Grand Haven 6 feet deep and 40 to 100 feet wide (mostly 100 feet) except as follows: A distance of about 1,600 feet with depth of 6 feet and width of 20 to 40 feet; a distance of about 2,500 feet with depth of 5 feet; and a distance of about 700 feet with a depth of 4 to 5 feet. The maximum draft that could be carried June 30, 1909, from Grand Haven to Grand Rapids was 4.5 feet below low water surface. Thus there is a total of 5,800 feet in which the channel is dificient either in depth or in width to such an extent as to offer a barrier to vessels of the maximum size adapted to the facilities of the authorized project. These localities have in the past been improved to afford the projected depth, but constant maintenance is required.

The contraction works are in fairly good condition.

The project is naturally one of constant repair and maintenance. High water ordinarily occurs in the early spring, and is from 12 to 18 feet above low water in the neighborhood of Grand Rapids. In the lower part of the river the difference between the high and low stages becomes less, and at the mouth it is inconsiderable.

The commerce involved must be stated as insignificant. A boat line of two new boats (each 219 tonnage and 700 passenger allowance), called the Grand Rapids and Lake Michigan Transportation Company, was put in operation three years ago between Grand Rapids and Grand Haven, but failed to find business, and the boats have been sold and removed from the river.

With the exception of a gasoline boat, which is running between Grand Rapids and Grand Haven, there is no commerce on the 23 miles of improved river between Grand Rapids and Bass River, but below Bass River there are two small tugs engaged in towing gravel to Grand Haven.

At present there is an available balance of $40,874.52, which is more than enough for such work as, in view of the limited commercial use of the channel, seems justifiable during the years 1909, 1910, and 1911. No appropriation will therefore be needed.

The improvement has no effect on freight rates, and it is improbable that it ever will have, since the better facilities afforded by the competing interurban electric lines to Holland, Grand Haven, and Muskegon have served to divert to them freight shipped by vessel to and from Chicago, which might otherwise have been regarded as peculiarly tributary to a line of steamers running between Grand Rapids and Grand Haven and connecting at the latter place with trans-lake steamships.

Freight carried, calendar year 1906, 110,395 tons; 1907, 88,653 tons; and in 1908, 25,913 tons.

Reference to report on examination made in compliance with act of March 2, 1907, may be found on page 715 of report for 1908.

July 1, 1908, balance unexpended		$68, 324. 64
Proceeds of sale of government property		240. 00
		68, 564. 64
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$11, 849. 01	
For maintenance of improvement	14, 600. 14	
		26, 449. 15
July 1, 1909, balance unexpended		42, 115. 49
July 1, 1909, outstanding liabilities		1, 240. 97
July 1, 1909, balance available		40, 874. 52
Amount (estimated) required for completion of existing project		149, 000. 00

(See Appendix M M 6.)

7. *Muskegon Harbor, Michigan.*—This harbor is the outlet of Muskegon River, one of the largest in Michigan, which before emptying into Lake Michigan expands into Muskegon Lake. The channel between the lakes in 1867, before operations were begun by the United States, was 3,000 feet long and about 12 feet deep, except at the entrance, where the depth was 11 feet and the channel fluctuating. By private enterprise the entrance had been protected by converging slab piers.

The original project was adopted in 1866 and amended in 1869, 1873, 1881, 1884, 1890, and 1892. To June 30, 1902, there had been expended upon this project the sum of $526,293.36, of which $388,218.42 was for construction and $138,074.94 for maintenance, and there had been constructed a north pier and revetment 2,780 feet long and a south pier and revetment 4,402 feet long, protecting a channel varying in width from 308 feet at the entrance to 167 feet inside and having a proposed depth of 15 feet.

The existing project, adopted by the act of June 13, 1902, provides for widening the channel to 300 feet and deepening it to 20 feet from Lake Michigan to Muskegon Lake. This involved the removal of the narrowing portion of the north pier and revetment, the reconstruction of the same on new line, the extension of both revetments to

Muskegon Lake, and the outward extension of the two piers by an aggregate amount of 550 feet. The estimated cost was $380,000.

From July 1, 1902, to June 30, 1909, there was expended upon the existing project the sum of $222,640.64, of which $137,660.80 was for construction and $84,979.84 for maintenance.

The operations during the fiscal year were as follows: The construction of 1,200 feet of sheet pile revetment on the north side of the channel, which was begun in the previous fiscal year, was nearly completed in June, 1909, the only item remaining being the spiking of part of the lower guide timbers. The contract dredging commenced May 4, 1908, for the removal of the interior portion of the old north pier and the widening of the channel as far as the new revetment then extended, was completed July 27, 1908. Dredging under a new contract for widening and deepening the channel to the present end of the north revetment and deepening it beyond to Muskegon Lake was begun June 8 and is now in progress. All the above operations come under the head of new work. Under the head of maintenance, the U. S. dredge *Gillespie* was employed at the harbor from August 1 to September 1, from October 30 to November 11, from January 4 to 9 and January 25–26, and again from May 21 to July 1, 1909, in maintaining and restoring the required depth. The total quantity dredged by the *Gillespie* during the stated times was 167,344 cubic yards. An obstruction found by the *Gillespie* in mid-channel opposite the life-saving station was removed by a dipper dredge under special agreement.

The present project is about 63 per cent completed.

The length of the completed pier and revetment construction at the present time is 4,150 feet on the north side and 4,710 feet on the south side of the channel, and the maximum draft on June 30, 1909, was 20 feet.

Commerce at this port for 1908 comprised 1,131 entrances and clearances with 115,269 short tons of cargo, valued at $13,522,000, and was mostly local in character. The local freight rates from Muskegon to Chicago by vessel are about 14 per cent lower than the corresponding rates by railroad.

There are 350 linear feet at the outer end of the north pier that are 24 to 27 years old and in need of repairs above water.

The completion of the project will require 550 feet of pier extension, the remainder of the dredging in the channel between the piers so as to afford 300 feet width and 20 feet depth and the extension of the revetments on the north side of the channel 1,100 feet to Muskegon Lake, estimated to cost $124,750.

The funds remaining available, after paying contract liabilities, will be sufficient for repairing the defective portion of the north pier and for dredging for maintenance by the *Gillespie* during the remainder of the season of 1909. For maintenance of the improvement until June 30, 1911, for completion of the sheet pile revetment on the north side of channel to Muskegon Lake, for dredging the full depth and width of interior channel, and for dredging at the entrance by the U. S. dredge *Gillespie*, it is estimated that $70,000 should be appropriated.

During the season of navigation two lines of steamers regularly use this harbor, which is a terminus of three important railroad lines. Their business is a substantial one, and with increased facilities should grow considerably. A general freight and passenger business is done, and in the summer months this is largely augmented by the fruit and the resort traffic. Muskegon Lake itself is a magnificent harbor, 5 miles long and about 1½ miles wide, with depths varying from 30 to 40 feet. When readily accessible, this will be an excellent harbor of refuge.

The Annual Report of the Chief of Engineers for 1901, pages 3131–3134, and House Document No. 104, Fifty-sixth Congress, second session, contain in full a report upon which the approved project is based. A map showing the harbor and the outlines of the above project accompanies the document mentioned.

It is reported that the project has had a marked influence in providing transportation facilities for commodities at reduced rates.

A report upon a preliminary examination of Muskegon Harbor, made in pursuance of the requirements of the act approved March 3, 1909, was submitted by the district officer under date of May 28, 1909, and will be transmitted to Congress at its next session.

July 1, 1908, balance unexpended		$90,236.65
Amount allotted from appropriation by river and harbor act approved March 3, 1909		22,000.00
		112,236.65
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$43,154.79	
For maintenance of improvement	16,405.86	
		59,560.65
July 1, 1909, balance unexpended		52,676.00
July 1, 1909, outstanding liabilities		4,006.18
July 1, 1909, balance available		48,669.82
July 1, 1909, amount covered by uncompleted contracts		30,685.72
Amount (estimated) required for completion of existing project		124,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		70,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix M M 7.)

8. *White Lake and Pentwater harbors, Michigan.*—These harbors were formerly carried as separate works, but are now consolidated in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *White Lake Harbor.*—When the present project was adopted, the natural outlet of White Lake, about 3,550 feet north of the present entrance, afforded a channel 5 feet deep and 125 feet wide between slab piers built by local enterprise.

The approved project provided for the abandonment of the old outlet and the creation of a new one, 12 feet deep and 200 feet wide between piers and revetments. This project was adopted in 1866, amended in 1873, 1884, and 1892, the present amended estimated cost being $353,550. The various amendments to the original project have not altered it materially, as they relate principally to the length of the proposed piers and revetments. The provision in the act approved March 2, 1907, that "the Secretary of War is authorized to dredge the channel at Pentwater to the depth of 16 feet and to dredge the channel at White Lake to sufficient depth to allow the free use of the government dredge *Gillespie*," may be said to have changed the project to one of 16-foot depth and 200 feet width between piers and revetments.

To June 30, 1909, there was expended upon the existing project the sum of $351,032.40, of which $207,862.44 was for construction and $143,169.96 for maintenance.

There have been no operations at the harbor during the fiscal year, and the expenditures have been for making the customary soundings and for contingencies and for dredging by the *Gillespie* in last fiscal year. An emergency contract for refilling parts of the piers with stone was entered into July 1, 1908, but no stone has as yet been delivered. It is probable that the stone will be received soon.

The proportion of the approved project completed to June 30, 1909, is about 91 per cent. The existing constructions consist of a north pier and revetment 1,715 feet long, and of a south pier and revetment 1,953 feet long, and the natural depth of channel between them is about 10 feet. Periodical dredging is necessary to secure and maintain a depth of 16 feet. The maximum draft that could be carried over the shoalest part of the channel at the end of the fiscal year was 13 feet.

In 1908 there was at this harbor 224 arrivals and departures, with 12,549 short tons of cargo, valued at $475,000, and entirely local in character. The local freight rates by vessel from White Lake to Chicago are about 14 per cent less than the corresponding rates by railroad.

The harbor is but 10.5 miles north of Muskegon.

After providing for the estimated cost of the stone to be delivered under the outstanding contract, and without use of the $67,000 allotted from the appropriation of March 3, 1909, for repairing the piers, the remaining balance of available funds will be sufficient to pay for the required dredging in 1909, for which bids will be invited early in July.

The conditions at White Lake Harbor were made the subject of a special investigation by the district officer, whose report was referred for review by the Board of Engineers for Rivers and Harbors. In the opinion of the Board this harbor is not worthy of further improvement by the General Government, and even the outlay necessary for maintenance and repairs would greatly exceed that warranted by existing and prospective commerce. Concurring in the views of the Board and in compliance with section 7 of the river and harbor act of March 3, 1899, it is recommended that further appropriations for White Lake Harbor be discontinued. A brief statement of the reasons for regarding the locality as unworthy of improvement may be found in Appendix MM 8 of this report.

However, pending action by Congress, providing for the definite abandonment of the improvement, and since funds for maintenance have been specifically provided, it is believed that dredging and minor repairs to afford facilities for the existing commerce should be done, and it is proposed to reserve $10,000 for repairs and $6,000 for dredging in 1910 and 1911 from the allotment made available from the appropriation by the act of March 3, 1909.

The last published map of the locality is contained in the Annual Report of the Chief of Engineers for 1884, page 1982.

(*b*) *Pentwater Harbor.*—Before work was begun at this harbor by the United States there existed an irregular channel 4 feet deep and 75 feet wide between slab piers built by local enterprise.

The existing project, adopted in 1867 and amended in 1873, 1884, and 1892, provides for widening the old entrance to 150 feet and deepening it to 12 feet, the sides being protected by piers and revetments. Estimated cost was $327,713.40. The amendments to the original project relate merely to the length of the proposed piers and revetments and in no wise enlarge its original scope. The present project, by reason of the provision in the act of March 2, 1907, contemplates a channel 16 feet deep and about 150 feet wide, protected by suitable piers and revetments.

To June 30, 1909, there was expended the sum of $312,533.32, of which $179,899.10 was for construction and $132,634.22 for maintenance. There have been no operations during the past fiscal year, and the expenditures were made for the customary soundings.

The proportion of the approved project completed to June 30, 1909, is about 85 per cent.

The result is a channel 140 to 153 feet wide, whose natural depth is from 9 to 10 feet, protected by a north pier and revetment 2,226 feet long and a south pier and revetment 1,847 feet long. Periodical dredging is necessary to secure the projected depth of 16 feet. The maximum draft which on June 30, 1909, could be carried over the shoalest point in the improved channel was 12.6 feet.

The lake commerce at this port for 1908 consisted of 1,354 arrivals and departures, with 2,431 short tons of cargo valued at $340,000 and entirely of local character. The local freight rates by vessel to Chicago are about 20 per cent less than the corresponding rates by railroad.

The following table gives the vessel commerce of Pentwater Harbor since 1900:

Calendar year.	Freight received.	Freight shipped.	Total freight carried.	Increase or decrease over previous year.
	Tons.	*Tons.*	*Tons.*	
1900	13,288	16,465	29,753	....
1901	1,000	5,070	6,070	−23,683
1902	(*a*)	(*a*)	(*a*)	(*a*)
1903	8,675	13,555	22,230	....
1904	3,000	12,423	15,423	− 6,807
1905	1,128	1,712	2,840	−12,583
1906	2,175	11,238	13,413	+10,573
1907	875	1,657	2,532	−10,881
1908	1,051	1,359	2,410	− 122

a Not reported.

This table shows that during the calendar years 1906, 1907, and 1908, the total vessel freight movement was about 18,355 tons, and the records of this office show during the same years a total expenditure by the United States of $19,024, or $1.04 for each ton of vessel freight. The cost to the United States is evidently unjustifiably great.

The conditions at Pentwater Harbor were made the subject of a special investigation by the district officer, whose report was referred for review by the Board of Engineers for Rivers and Harbors. After considering the past, present, and prospective commerce of the locality, the sum expended on its improvement, and the necessary expense attending its future maintenance, the Board expressed the opinion that it is not desirable for the United States to make further expenditures for the improvement or maintenance of this harbor. Concurring in the views of the Board and in compliance with section 7 of the river and harbor act of March 3, 1899, it is recommended that further appropriations for Pentwater Harbor be discontinued.

Since, however, funds for maintenance have been specifically provided and pending action by Congress providing for the definite abandonment of the improvement, it is believed that dredging and minor repairs to afford facilities for the existing commerce should be done, and it is therefore proposed to reserve $10,000 for repairs and $6,000 for dredging in 1910 and 1911 from the allotment made available from the appropriation by the act of March 3, 1909.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1980.

WHITE LAKE HARBOR.

July 1, 1908, balance unexpended	$7,569.01
Proceeds of sale of government property	1,150.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	16,000.00
	24,719.01
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,050.11
July 1, 1909, balance unexpended	23,668.90
July 1, 1909, amount covered by uncompleted contracts	2,490.50
Amount (estimated) required for completion of existing project	21,720.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

PENTWATER HARBOR.

July 1, 1908, balance unexpended	$3,355.31
Amount allotted from appropriation by river and harbor act approved March 3, 1909	16,000.00
	19,355.31
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	[b] 68.63
July 1, 1909, balance unexpended	19,286.68
Amount (estimated) required for completion of existing project	26,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

---

[a] See consolidated money statement on page 742.

[b] Exclusive of $1.33, refundment of overpayment, which has been deducted from expenditures during the fiscal year.

CONSOLIDATED.

July 1, 1908, balance unexpended	$10,924.32
Proceeds of sale of government property	1,150.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	32,000.00
	44,074.32
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,118.74
July 1, 1909, balance unexpended	[a]42,955.58
July 1, 1909, amount covered by uncompleted contracts	2,490.50
Amount (estimated) required for completion of existing project	48,120.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[b]4,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M M 8.)

9. *Ludington Harbor, Michigan.*—This harbor is the outlet of Pere Marquette River, which expands into Pere Marquette Lake before emptying into Lake Michigan. In 1867, before improvement was begun by the United States, the outlet from Pere Marquette Lake to Lake Michigan had a length of 830 feet, protected by diverging slab piers. The entering depth was 7 to 8 feet.

The former project was adopted in 1867 and modified in 1885, 1889, 1890, and 1899. In its final form, as adopted by the river and harbor act of March 3, 1899, it provided for a through channel 183 to 285 feet wide and 18 feet deep, protected by the requisite piers and revetments. The estimated amount required to complete the revised project was $210,000. The development of the harbor has been progressive, the changes in the original project affecting only the length of the piers, their direction and the depth between them. It may therefore be said that the estimated cost of completion of that project is really the sum of the above amount and that previously expended, or $591,055.91 in all.

To June 30, 1909, the sum of $712,698.78 was expended upon the original project and its subsequent modifications. Of the above, $579,870.79 was expended for construction and $132,827.99 for maintenance. As a result of the above expenditure there now exists a reasonably reliable 18-foot channel, protected by piers and revetments. Annual dredging is necessary, however, to maintain a channel 18 feet in depth and of sufficient width.

The present project, as adopted by the act of Congress of March 2, 1907, provides for an interior channel 18 feet deep, protected by piers and revetments, and for an exterior basin, to be formed by two breakwaters of crib construction, each 1,800 feet long, 400 feet apart at the outer ends and diverging at an angle of 90 degrees, the inner ends of the breakwaters to be connected with the shore by suitable structures. The estimated cost of this project was $839,087. A continuing contract for the construction of the breakwaters, not including the shore connections, was entered into under date of December 10, 1907, the remaining work to be placed under contract at a later date.

---

[a] In addition to this amount, the sum of $69,000, made available by the river and harbor act of March 3, 1909, remains unallotted.

[b] Since the preparation of this estimate these harbors have been made the subject of a special investigation and report, as a result of which they are now regarded as unworthy of further improvement by the United States. Pending the further action by Congress in the premises, this estimate may be omitted.

The amount expended under the present project to June 30, 1909, was $88,454.57, all of which was for new work.

Under the continuing contract the following work was done during the fiscal year: For the south breakwater five additional cribs, each 100 feet long, were built, six cribs were sunk on their pile foundations, and the superstructure was completed for a length of 343 feet. For the north breakwater the construction of four cribs was completed, two cribs were sunk, and the construction of the superstructure was begun. Under the head of maintenance, the damaged inner end of the north pier was repaired, and 590 linear feet of that pier was strengthened with additional piles. The filling in parts of the south pier was replenished. The channel between the piers was deepened October 16–17 and again May 5–7 and May 17–19 by the government dredge, the total quantity dredged being 14,830 yards. The dredging in May was occasioned by the grounding on May 3 of the deep draft coal barge *New York*. The *Gillespie* was at once ordered to Ludington and the barge was released May 5.

The existing project gives authority for entering into continuing contracts to complete the improvement at a cost not to exceed $839,087, of which amount $519,087 remains to be appropriated.

The original project for the interior harbor is completed. The proportion of the project of 1907 completed to June 30, 1909, is 16 per cent. The maximum draft that could be carried at the end of the fiscal year was 19 feet.

The water-borne commerce at this harbor has averaged for the last ten years 1,329,878 short tons, and in 1908 it consisted of 3,528 entrances and clearances, with 1,416,560 short tons of cargo, valued at $149,553,000, and was general in character. The local freight rates by vessel to Chicago are about 29 per cent less than the corresponding rates by railroad.

Excluding contract obligations, but including the allotment of $8,000 from the appropriation of the act of March 3, 1909, there is at present available a total of $9,161.84 besides the amount necessarily reserved for contingencies, and this amount is sufficient to pay for needed dredging and incidental repairs during the remainder of 1909 and in 1910. During the fiscal year ending June 30, 1911, there may be profitably expended the following:

For continuing improvement, as authorized, under continuing contract....	$300,000
For maintenance by dredging....	5,000
For maintenance, incidental repairs, and contingencies....	5,000
Total....	310,000

The report upon which the project of 1907 is based is printed in House Document No. 62, Fifty-ninth Congress, first session.

This harbor is one terminus of the main line of the Pere Marquette Railroad Company, which operates lines of car ferries from this point to Manitowoc, Wis., and Milwaukee, Wis. Lines of passenger and package freight steamers also make regular sailings to Milwaukee and Chicago. The business done by the car-ferry lines is of enormous and constantly increasing importance in its effect upon freight rates to and from the Northwest. It is desirable to give to the car-ferry service the same assurance of regularity of schedule as exists in the case of the ordinary railroad lines. At present difficulty is usually experienced in the fall and winter months, due to the narrowing of the channel by a shoal from the north. The car ferries are large and unwieldy and require ample sea room. A narrow channel is therefore impracticable, and to insure safety and regularity to the service repeated dredging is necessary, for which the United States seagoing hydraulic dredge is now available.

The effect of the improvement has been to create a class of traffic which, in the absence of a deep and readily available channel, could never have existed. There has thus been provided a shorter route for the products of the upper Mississippi Valley, which has the additional merit of avoiding the congestion usually existing on the railroads at the south shore of Lake Michigan. Freight rates are believed to have been materially reduced by this route.

July 1, 1908, balance unexpended		$161,731.67
Amount allotted from appropriation by river and harbor act of March 3, 1909		8,000.00
Amount appropriated by sundry civil act approved March 4, 1909		200,000.00
		369,731.67
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$87,428.06	
For maintenance of improvement	3,567.87	
		[a] 90,995.93
July 1, 1909, balance unexpended		[b] 278,735.74
July 1, 1909, outstanding liabilities		500.15
July 1, 1909, balance available		278,235.59
July 1, 1909, amount covered by uncompleted contracts		251,560.11
Amount (estimated) required for completion of existing project		519,087.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$300,000.00	
For maintenance of improvement	10,000.00	
		310,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix M M 9.)

10. Manistee Harbor, Michigan.—In 1866, previous to the beginning of work by the United States, the entrance to this harbor was improved by slab piers, 100 to 150 feet apart, built by local enterprise, a navigable depth of 7 to 8 feet being thereby maintained.

The project adopted in 1867 and amended in 1871, 1873, 1875, 1884, 1890, and 1892, provides for a channel of navigable width with a depth of 15 feet, extending from Lake Michigan to Manistee Lake, protected by piers and revetments at the entrance. The various modifications of the original project merely extended its limits, changed the proposed length of the piers, and the proposed depth from 12 to 15 feet. Operations have been progressive, and no work under any project not essential to its final form has been done.

---

[a] Exclusive of $226.17 expended account Isthmian Canal Commission, of which $155.61 has been reimbursed.

[b] Inclusive of $70.56 to be reimbursed by Isthmian Canal Commission.

To June 30, 1909, there had been expended $448,614.40, of which $329,996.18 was for construction and $118,618.22 for maintenance.

As a result of the above total expenditure to June 30, 1909, there had been built 2,906 linear feet of north and 1,450 linear feet of south pier and revetment, the width between the piers varying between 150 feet inside and 190 feet at the outer end of the south pier, which is 250 feet shorter than the north pier. The portion of the north revetment occupied by the Manistee and Northeastern Railroad Company, referred to in the Annual Report of the Chief of Engineers for 1899, page 2940, still remains without repairs.

The act approved March 2, 1907, changed the project by providing for improvement in accordance with the report submitted in House Document No. 511, Fifty-ninth Congress, first session, which contemplates securing a uniform depth of 18 feet, by dredging to a depth of 20 feet, pier extension, revetment, and protection works, at an estimated cost of $147,488, provided satisfactory pledge is given that certain private and municipal work will be completed within a reasonable time, that land for the improvement will be donated, and that the United States will be protected from claims for damages which may result from the work. No expenditures have yet been incurred on account of the modified project, approved March 2, 1907.

The following is a summary of the operations during the past fiscal year: Dredging under contract for widening the channel in the river, begun June 22, 1908, was completed July 11, and the channel at the entrance and through the outer bar was deepened November 12-23 by the *Gillespie* to 20 feet. Under an emergency contract, dated July 1, parts of the two piers were refilled with stone, and on May 20 operations under contract were begun for thoroughly repairing the north pier between stations 7+69 and 12+38.7. All these operations come under the head of maintenance.

Of the original project 95 per cent is completed, and, as already stated, no work has yet been done upon the modified project of 1907. The maximum draft which on June 30, 1909, could be carried was 15 feet.

The vessel commerce at this port for the last ten years has averaged 526,956 short tons, and in 1908 it amounted to 2,116 entrances and clearances with 428,084 short tons of cargo, valued at $17,411,000, principally local in character. Definite information as to the effect of the improvement upon freight rates could not be obtained, but the local freight rates by vessel from Manistee to Chicago are about 30 per cent less than the corresponding rates by railroad.

As the conditions precedent to beginning work under the project of 1907 have not yet been met, the project of 1892 remains in force. After deducting outstanding obligations and contingencies, a balance of $11,228.44 remains available, which will permit dredging at the entrance by the *Gillespie* during two seasons and additional repairs when required.

During the year ending June 30, 1911, there may profitably be expended for maintenance of improvement the following:

For repair of outer end of north pier	$2,000
For incidental repairs	5,000
For dredging at entrance by *Gillespie*	5,000
For dredging in upper reaches of channel by contract	10,000
Total	22,000

The commerce tributary to this harbor is derived principally from the salt and lumber industries. The harbor is also a regular port of call for one line of steamers plying from Chicago to points upon the east shore of Lake Michigan, and a single steamer makes stated trips from Manistee to Milwaukee. There are three railroads running into Manistee, the Pere Marquette, the Manistee and Grand Rapids, and the Manistee and Northeastern.

Reference to reports on preliminary examination and survey, ordered by the river and harbor act approved March 3, 1905, will be found on page 644 of the report for 1906.

The last published map of this locality is found in House Document No. 511, Fifty-ninth Congress, first session.

July 1, 1908, balance unexpended	$29,549.27
June 30, 1909, amount expended during fiscal year for maintenence of improvement	6,138.80
July 1, 1909, balance unexpended	23,410.47
July 1, 1909, outstanding liabilities	120.25
July 1, 1909, balance available	23,290.22
July 1, 1909, amount covered by uncompleted contracts	10,604.86
Amount (estimated) required for completion of existing project	122,488.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	22,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M M 10.)

11. Harbor of refuge at Portage Lake, Manistee County, Mich.—In 1879, when work was begun by the United States, there was a channel 4 feet deep and 130 feet wide between slab piers built by local enterprise.

The approved project, adopted in 1879 and amended in 1881 and 1890, contemplates the construction of a harbor of refuge, with an entrance from Lake Michigan 356 feet wide and 18 feet deep, protected by piers and revetments. Estimated cost, revised in 1897 and 1899, was $344,300.

The modifications of the original project have in no way changed its scope, so that essentially the project is to-day as when originally adopted. All expenditures made up to the present time have contributed to the completion of the project in its present form.

To June 30, 1909, there had been expended the sum of $376,566.28, of which $254,129.21 was for construction and $122,437.07 for maintenance.

There was no work of improvement carried on at this harbor during the fiscal year. The expenditures were incurred for surveying purposes.

The approved project is completed as far as pier construction is concerned, but the dredging to the proposed width and depth remains as yet incomplete.

The harbor structures are in good condition. The north pier, comprising 114 feet of pile work in wing at inner end, 1,235 feet of pile work along channel, and 851 feet of cribwork, has a total length of 2,200 feet and projects 1,210 feet beyond the shore line. The south pier, comprising 1,399 feet of pile work, including 17 feet of wing at east end, and 901 feet of cribwork, has a total length of 2,300 feet and projects 1,150 feet beyond the shore line.

As shown by soundings made May 11–12, the maximum draft that could be carried from Lake Michigan to Portage Lake, on June 30, 1909, was 17 feet.

The vessel commerce at this harbor for 1908 was 480 arrivals and departures with 3,441 short tons of cargo, valued at $147,000, and was entirely local in character.

This harbor is one practically destitute of local or through commerce, and, while it is doubtful whether a harbor of refuge here will ever be of much service, no just conclusion can be drawn until a channel of ample depth and width has been made available. Unless this is done the larger class of vessels can not use the harbor and the large expenditures already made will, to a considerable extent, be useless. The only way to arrive at a satisfactory determination of the question whether or not vessels will turn aside from the usual vessel course in order to take shelter here is to complete the authorized project, and an estimate for this purpose and for maintenance is accordingly presented. The balance at present available is about $2,900, which will pay for a short period of dredging by the *Gillespie* and for contingencies.

The estimate of funds which can profitably be expended in the fiscal year ending June 30, 1911, is as follows:

For works of improvement: For dredging by contract		$15,000.00
For maintenance of improvement:		
For dredging in 1910 and 1911	$6,000	
For repairs and contingencies	5,000	
		11,000.00
Total		26,000.00

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1974.

July 1, 1908, balance unexpended	$3,008.22
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	74.50
July 1, 1909, balance unexpended	2,933.72
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	26,000.00

(See Appendix M M 11.)

12. *Arcadia Harbor, Michigan.*—The act of March 3, 1905, appropriated $6,000 for the improvement of this harbor in accordance with report submitted in House Document No. 194, Fifty-eighth Congress, second session.

While a plan was submitted for rebuilding the piers at a cost of $90,390, and annual maintenance and dredging at a cost of $5,200, the plan that was recommended and approved was for maintenance of the present channel by dredging only, at a cost of $3,000 annually for a period of five years, at the end of which time, if a growth of the commerce had been manifested such as to warrent larger expenditures, the plan for radical improvement by reconstruction of the piers could be undertaken. At the time of the survey, September, 1902, the depth was some 12 feet in a narrow and rather difficult channel, produced and maintained by repeated dredging at local expense, and this depth was subject to considerable reduction during the usual lowering of the lake surface in the months of October and April, so that only 10 feet could be safely counted on as the navigable depth. The piers terminate at the 10-foot contour.

To June 30, 1909, there had been expended $12,038.75 for dredging.

The channel was surveyed April 30 to May 6, 1909, and the available depth between the piers was found to be 6.2 feet.

Dredging operations under contract were commenced June 8 and completed June 25, and resulted in restoring a channel 12 feet deep and 50 feet wide from the inner lake to Lake Michigan. The dredged material measured 13,888 cubic yards.

The approved project is completed by reason of the expiration of the authorized period of five years for maintenance by dredging. The benefit resulting from the five year's dredging operations is not of a lasting nature. The effect of each season's dredging was always found entirely obliterated in the following spring, and it can not be expected that a useful channel will be found in 1910. The maximum draft that could be carried on June 30, 1909, was 12 feet.

The number of tons of various articles shipped and received and the entrances and clearances of vessels from 1894 to 1901, inclusive, are shown on page 576 in Report of Chief of Engineers for 1905.

The vessel commerce at this harbor for 1908 was 2,975 short tons, valued at $125,000, and entirely local in character.

The act of March 3, 1909, carried an allotment of $3,000, being the fifth and last installment under the project. For this reason no estimate may now be presented to cover the needs of the fiscal year ending June 30, 1911.

July 1, 1908, balance unexpended	$461.52
Amount allotted from appropriation by river and harbor act approved March 3, 1909	3,000.00
	3,461.52
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	500.27
July 1, 1909, balance unexpended	2,961.25
July 1, 1909, outstanding liabilities	69.55
July 1, 1909, balance available	2,891.70
July 1, 1909, amount covered by uncompleted contracts	2,700.00

(See Appendix M M 12.)

13. Frankfort Harbor, Michigan.—In 1867, when the United States began work of improvement at this harbor, which is the entrance to Lake Aux Becs Scies, there existed an outlet about 750 feet north of the present channel, affording a depth of 3 to 4 feet and width of 70 to 80 feet between slab piers, built by local enterprise.

The project, adopted in 1866 and amended in 1868, 1879, and 1892, provided for a new outlet, with channel 12 feet deep and 200 feet wide, protected by piers and revetments. The estimated cost, revised in 1897 in compliance with the river and harbor act of June 3, 1896, to cover the cost of securing a channel 18 feet deep, was $413,659.85; further revised in 1899 to $421,938.35. The changes in the original project have been in effect merely extensions, so that the existing project does not differ in kind from the original one. All expenditures may therefore justly be regarded as pertaining to the present project.

To June 30, 1909, there had been expended the sum of $443,710.61, of which $321,508.20 was for construction and $122,202.41 for maintenance.

The following is a summary of the operations during the fiscal year: The contractors for the extension and repair of the south pier prepared the foundation of the new crib by removing the shattered 40 feet of the old work and preparing the foundation for the additional 60 feet to be covered by the new crib and completed the construction of the new crib. Most of this work was done before the close of the working season of 1908. In the money accounts of this work it will be assumed that 60 per cent of the total cost of this crib must be assigned to new work and 40 per cent to maintenance.

Under a contract dated March 1, for repairing the south pier between stations 0+89.6 and 1+86.6, operations began May 18, but the only work accomplished to the end of the fiscal year was the removal of the ruined old structure.

Between October 3 and 15 the *Gillespie* deepened the outer approach to 20 feet. On March 12 the available depth outside was found to be 18.5 feet, and between the piers 18.2 feet in a very narrow and irregular channel. The *Gillespie* improved this condition April 28 to May 15, the resulting depth being 19.3 feet. The total quantity dredged at this location by the *Gillespie* during the year was 54,716 cubic yards.

The approved project is about 95 per cent completed.

The total expenditure above mentioned has resulted in the creation and maintenance of a channel 18 feet deep, whose natural depth, or depth to which the channel would probably shoal in a few years without dredging, is 12 feet, the width being 200 feet. It is protected by a north pier and revetment 1,900 feet long and a south pier and revetment 1,938 feet long, of which the outer 400 feet was built by the Toledo and Ann Arbor Railroad Company. Dredging from time to time will be required to maintain the depths needed for navigation. The maximum draft that could be carried June 30, 1909, was 19 feet.

Practically the entire commerce of this harbor is transacted by the car-ferry lines of the Ann Arbor Railroad, which has its northern terminus at this harbor. These car ferries run to Kewaunee and Marinette, Wis., upon the west shore of Lake Michigan, and form a highly important link in the through commerce between the Northwest and the Atlantic seaboard. The importance of maintaining adequate facilities at Frankfort Harbor is manifest. This can be done with certainty only by repeated radical dredging. Pier extension unaccompanied by thorough dredging will not serve.

The water-borne commerce at this port has averaged for the last ten years 741,231 short tons, and in 1908 it amounted to 1,330 entrances and clearances with 563,332 short tons of cargo, valued at $61,419,000 and for the most part general in character.

The available balance at this harbor is nearly $10,000, which is sufficient to pay for dredging by the *Gillespie* until June 30, 1911. For the maintenance of the harbor structures until that time, an appropriation of $6,800 is recommended and $13,200 should be appropriated for the addition of 100 feet to the north pier to complete the project.

The last published map of this harbor is found in the Annual Report of the Chief of Engineers for 1884, page 1973.

July 1, 1908, balance unexpended	$35,696.54
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,968.80
July 1, 1909, balance unexpended	28,727.74
July 1, 1909, outstanding liabilities	160.28
July 1, 1909, balance available	28,567.46
July 1, 1909, amount covered by uncompleted contracts	18,844.54
Amount (estimated) required for completion of existing project	13,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M M 13.)

14. Charlevoix Harbor and entrance to Pine Lake, Michigan.—In 1868, when the first estimate for improvement was made, the available channel in Pine River between Lake Michigan and Round Lake was 75 feet wide and 2 to 6 feet deep. Up to 1873 the local authorities, with some assistance from the State, had constructed 468 feet of cribwork in the north pier and 80 feet of cribwork in the south pier, and the available depth was 6 feet. The first appropriation by the United States was made in 1876, and actual operations upon the lower channel were begun in the fiscal year 1878; the first appropriation for the upper channel was made in 1882, and actual work begun in 1885. The total estimated cost was $186,000.

The original project, as proposed in 1868, and amended in 1876 and 1882, provided for a 12-foot channel from Lake Michigan to Round Lake (lower channel), between piers and revetments, 100 to 150 feet apart, and from Round Lake to Pine Lake (upper channel), between revetments, 83 feet apart. The following provision of the river and harbor act of June 13, 1902, may be said to have extended the scope of the original project: "Improving harbor at Charlevoix and entrance to Pine Lake, Michigan: Continuing improvement, twenty thousand dollars, to be first expended in obtaining a uniform depth of channel from Lake Michigan to Pine Lake." The controlling depth of the lower channel in June, 1902, was 16.3 feet.

The amount expended under the existing project (not including outstanding liabilities) to June 30, 1909, was $205,727.37, of which $80,205.04 was for construction and $125,522.33 for maintenance.

No works of improvement have been in progress during the fiscal year, and the amounts expended were for the payment of outstanding liabilities, survey, and contingencies.

About 70 per cent of the pier construction contemplated by the approved project has been completed, the work remaining to be done being the extension of the south pier by 200 linear feet. The maximum draft that could be carried at the end of the fiscal year, as shown by soundings made June 22–24, was 16.7 feet.

The principal traffic tributary to this harbor is furnished by the lumber industry, which has recently been growing greatly in importance. The sawmills are situated at Boyne and East Jordan, both at the upper end of Pine Lake, the outlet for which is through both channels. Due to the fact that many of the lumber-carrying vessels do not clear at Charlevoix, the commercial statistics fail to disclose the full traffic, which is, however, known to be considerably over 1,000,000 tons. Charlevoix is also a much-frequented summer resort, and during the summer season two steamboat lines make regular and frequent calls at this harbor. There is in addition a small amount of local traffic. A depth of 17 feet at zero of gauge should be maintained to enable the larger class of vessels to transact their business with economy.

The lake commerce which cleared at this port for 1908 was 384 arrivals and departures, with 45,211 short tons of cargo, valued at $2,643,000, and was principally local in character. As stated this is considerably less than the true total.

At present there is available a balance of $20,848.84, of which it is proposed to apply $4,000 for the repair of the outer 200 feet of the south pier and $8,000 to dredging when needed, and the balance will be reserved for maintenance, for which purpose it will be ample. A better sheltered entrance seems desirable, and for this purpose it would be wise to complete the south pier as authorized, for which an appropriation of $23,750 is recommended for the fiscal year ending June 30, 1911.

The report upon a survey made with a view to obtaining a 16-foot channel is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2953–2954, and is also printed with a map in House Document No. 144, Fifty-fourth Congress, second session.

Report of the examination authorized by the river and harbor act approved June 13, 1902, has been printed as House Document No. 222, Fifty-eighth Congress, second session.

Definite information as to the effect of the improvement on freight rates could not be obtained.

July 1, 1908, balance unexpended	$18,990.12
Amount allotted from appropriation by river and harbor act approved March 3, 1909	6,000.00
	24,990.12
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,097.84
July 1, 1909, balance unexpended	20,892.28
July 1, 1909, outstanding liabilities	43.44
July 1, 1909, balance available	20,848.84

Amount (estimated) required for completion of existing project..........	$23,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909..........	23,750.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix M M 14.)

15. Petoskey Harbor, Michigan.—Before work at this harbor was begun by the United States its landing pier was exposed to winds coming from between west and northwest, and in high gales it was dangerous to attempt a landing.

A project was adopted in the river and harbor act of August 18, 1894, which provided for constructing a breakwater 600 feet long about 600 feet west of the outer end of the landing pier and another north of it 500 feet long, or as much longer as might be found necessary to cover the landing from all dangerous seas. Work was begun in 1896. Estimated cost was $170,000.

In 1902 the west breakwater had been built for a length of 400 feet and the north breakwater for a length of 200 feet. Investigation having shown that the north breakwater was too near the wharf and that the entrance between the two breakwaters was too narrow, the project was modified under authority conferred by the act of June 13, 1902, so as to provide for the removal of the north breakwater and the extension of the west breakwater, the final cost not to exceed the amount estimated to complete the original project, viz, $170,000.

The amount expended under the original project and as modified in 1902 up to June 30, 1909, has been $125,500, of which $118,239.40 was for new work and $7,260.60 for maintenance.

There has been no work of improvement in progress during the fiscal year; the sum of $8.34 was expended for contingencies.

The breakwater as now existing has a total length of 1,345 feet, consisting of 445 feet of stonework and 900 feet of cribwork. The amount expended for construction constitutes about 70 per cent of the estimated cost of the project.

The lake commerce which cleared at this port for 1908 was 20 entrances and departures with 858 short tons of cargo, valued at $212,000, entirely local in character.

The stone portion of the breakwater is in bad condition, and for the purpose of restoring its efficiency an appropriation of $5,000, for maintenance, is recommended for the fiscal year ending June 30, 1911, as well as $15,000 for the addition of 100 feet to the breakwater, which it is believed will answer all local needs.

Definite information as to the effect of the project on freight rates could not be obtained.

July 1, 1908, balance unexpended..........	$8.34
June 30, 1909, amount expended during fiscal year, for maintenance of improvement..........	8.34
Amount (estimated) required for completion of existing project..........	56,900.00

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance	$20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M M 15.)

16. U. S. dredge General Gillespie.[a]—This dredge is of the seagoing suction type, and was built in 1904 for use at the harbors on the east shore of Lake Michigan.

Since March 1, 1909, the work of this dredge has been closely supervised and verified. Under extremely favorable conditions this boat has been able to move a maximum of slightly more than 4,000 cubic yards in eight hours of actual work, but the average at all harbors and under all circumstances is about 3,000 yards per day of eight hours.

For dredging under precisely the same conditions in the past the contract cost with dipper dredges has been as high as 25 cents per cubic yard, and then work outside the piers was never possible until about the 1st of June, whereas the *Gillespie* works in the most exposed places at any and all seasons. The final average cost of her work for the period considered is 7.618 cents per cubic yard, and this is believed to fairly represent the cost of dredging under the conditions existing in this district. When compared with the performance of similar machines on the seacoast, the cost may seem high; but the circumstances under which this dredge is obliged to work—such as insufficient depth of water, etc.—affect unfavorably the final cost per unit.

A description of the boat and a tabular statement of the results of operating the *Gillespie* from March 19, 1909, to June 30, 1909, may be found in Appendix M M 16 of this report.

IMPROVEMENT OF RIVERS AND HARBORS IN THE DETROIT, MICHIGAN, DISTRICT.

This district was in the charge of Lieut. Col. C. McD. Townsend, Corps of Engineers, having under his immediate orders Capt. G. R. Spalding, Corps of Engineers, to July 27, 1908. Division engineer, Col. W. L. Fisk, Corps of Engineers.

1. Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.—In its natural state the channel connecting Lake Superior and Lake Huron was obstructed by the rapids of the St. Marys River, and navigation through other connecting channels was difficult and dangerous for boats drawing 8 feet. In 1855 the State of Michigan completed a canal at Sault Ste. Marie, with locks which were 350 feet long, 70 feet in width, and about 12 feet in depth on the miter sills. Prior to the civil war the channels through Lake George on the St. Marys River and through the St. Clair Flats at the outlet of St. Clair River were deepened to 12 feet by the General Government.

When the construction of the Weitzel lock was undertaken, providing for a navigable depth of 16 feet, it became necessary to increase channel depths not only at the localities above mentioned, but also at other localities on the St. Marys River and Detroit River. These improvements were made under specific appropriations for the localities where the work was required, as explained elsewhere in this report under the heads of St. Marys River, Hay Lake, St. Clair Flats, and Detroit River improvements.

---

[a] The name of this dredge has been changed to the *General G. G. Meade*.

When in 1890 the construction of the Poe lock was undertaken, providing for a depth over the miter sill of 21 feet at mean lake levels, a deepening of the channel at other localities became necessary, and the river and harbor act of July 13, 1892, authorized an expenditure of $3,340,000 for a ship channel "twenty and twenty-one feet deep, and a minimum width of 300 feet in the shallows of the connecting waters of the Great Lakes," at localities not especially provided for by the then existing appropriations.

This project originally provided for improvements at eight localities, i. e., (1) at Round Island shoals in the upper St. Marys River; (2) in Little Mud Lake, St. Marys River; (3) at Sailors Encampment, St. Marys River; (4) in Mud Lake, St. Marys River; (5) at the foot of Lake Huron; (6) at the mouth of the St. Clair River; (7) at entrance to the Detroit River in Lake St. Clair, and (8) at the mouth of the Detroit River. By 1897 channels 300 feet wide and 20 feet deep at mean lake level, as determined by gauge readings up to the time of the adoption of the project, had been secured at a cost of $2,212,000.

The sundry civil act of June 4, 1897, authorized the expenditure of the balance of the appropriation for the maintenance of the project and its further extension to localities where recent surveys had shown that greater depths were necessary. Since 1898, therefore, the expenditures from the available balance of the appropriation have been for widening and deepening the channels of the original project and for the removal of isolated shoals, usually of small area, which have been found to interfere with the safe navigation of the channel by the larger and deeper draft vessels now in commission. The principal additional works thus accomplished have been the widening of channel at Round Island shoals and the removal of the Vidal shoals in the upper St. Marys River, Squaw Island, and Sweet Point shoals at the mouth of the St. Marys River, Crab Island shoal in Detour Passage, the shoal in the St. Clair River at the mouth of the Black, the St. Clair Middle Ground shoal in the St. Clair River opposite the city of St. Clair, and Squirrel Island shoal in the same river. In addition a new channel west of Stag Island, St. Clair River, has been opened by the removal of several shoals interfering with deep-draft navigation, and considerable work in the Detroit River has been done that was not contemplated in the original project.

Since 1892 the levels of Lakes Huron, St. Clair, and Erie have been almost continuously below the plane adopted as mean lake level at the time of the authorization of the original project and, as a consequence, the actual draft available throughout the improved channels has varied from 17 to 19 feet. The slopes of the St. Marys River have also been affected by the dredging of channels through it. On account of these facts a new datum for the various improvements was adopted in 1902. This new datum plane is that of the low water of 1895, which varies, as explained in the Annual Report of the Chief of Engineers for 1904, page 552, from 2 to 3 feet below the mean lake levels. In addition to the annual variations in levels the mean monthly levels may vary from 4 inches to 2 feet in a single year, and daily variations in the water surface may amount to 2 feet in variable weather, or even to 6 and 8 feet in severe storms, on Lakes Superior and Erie.

The total expenditure on the improvements to June 30, 1909, was $3,340,000. With this expenditure and specific appropriations for special localities, channels not less than 300 feet in width, with depths varying from 20 to 23 feet below mean lake levels, have been constructed, connecting the waters of the Great Lakes between Chicago, Duluth, and Buffalo, as called for by the project.

The river and harbor act of March 3, 1909, appropriated $25,000 for maintenance and surveys, and $63.14 were expended during the fiscal year.

The only work done during the fiscal year ending June 30, 1909, has been the making of surveys of Round Island Middle ground, St. Marys River, and the enforcement of rules and regulations for navigating Stag Island channel in St. Clair River.

The amount of freight carried through the St. Marys River section of the channel during the navigation season of 1908 was 41,390,557 freight tons, valued at $470,141,318, exclusive of local traffic amounting to about 1,500,000 tons. Statistics of traffic through the St. Clair Flats Canal indicate that 50,586,560 tons of freight passed through this section, while that passing Detroit River amounted to 54,086,750 tons, valued at $614,425,480.

It is believed that to attribute to the improvement in channels the difference in freight rates of 1900 (1.18 mills per mile-ton) and 1908 (0.69 mills per mile-ton) would not exaggerate the effect of the improvement, especially in view of the fact that the greater permissible draft has produced vessels of greater tonnage, the carrying capacity of freight steamers having increased from 8,000 tons in 1900 to 13,000 tons in 1907.

July 1, 1908, balance unexpended		$1,530.45
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,000.00
		26,530.45
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$1,530.45	
For maintenance of improvement	63.14	
		1,593.59
July 1, 1909, balance unexpended		24,936.86

(See Appendix N N 1.)

2. St. Marys River at the falls, Michigan.—The St. Marys rapids are about one-half mile wide and three-fourths of a mile long. The fall ranges from 16½ feet to 20½ feet with varying stages of water. The water surface, usually changing slowly, may have an extreme range of 6 feet in a few hours, and the monthly mean elevation of the surface may change as much as 2 feet in one year, or 4 feet during forty years.

Commercial navigation of the falls, or rapids, of this river at Sault Ste. Marie was impracticable until 1855, when the State of Michigan constructed a canal which provided a navigable channel for vessels whose draft was 11.5 feet at mean stage of water, at a cost of about $1,000,000, the proceeds of 750,000 acres of land granted by the United States Congress. This improvement was completed in

1855, the double-lift lock having tandem chambers 350 feet long and 70 feet wide, with gate openings of 70 feet arranged for 9 feet average lift at each lock, and the canal being about 5,700 feet long, with an available width of 64 feet and a top width of 100 feet. The commerce in 1870 was about 540,000 tons per year.

In 1870 the United States entered upon a project for increasing the canal to at least 100 feet width, replacing the stone slope walls with timber revetment piers, building a new lock, and providing for 16 feet draft. This lock (now known as the Weitzel lock) was opened to traffic in 1881, its single chamber being 515 feet long and 80 feet wide, narrowed at gate openings to 60 feet and arranged for 18 feet average lift. The cost of the work from 1856 to 1885, inclusive, was $2,625,692, including $10,000 diverted from the 1864 Great Lakes appropriation. A rapidly increasing commerce developed as a result of these improvements.

The project presented in reports dated October 18 and December 22, 1886, provided for building, on the site of the old state locks, a new lock with a single lift of 16 to 21 feet, the chamber being 800 feet long by 100 feet wide, with 21 feet of water at mean stage on the miter sills; also for deepening the canal and its approaches, all at an estimated cost of $4,738,865. By authority of river and harbor act of August 5, 1886, work under this project was begun, and the essential features of the project were so far completed in 1896 as to permit the new lock to be opened to navigation August 3 of that year. This lock has since been known as the Poe lock. Later work has consisted in completing the deepening of the canal and its approaches, rebuilding and extending canal piers, grading and improving canal grounds, etc.

The river and harbor act of June 13, 1902, authorized the following diversions from existing funds, namely, $20,000 for special improvement at Sailors Encampment, $20,000 for salaries and expenses of the International Waterways Commission, and $86,491.28, the amount required to complete certain improvements at St. Clair Flats Canal, for which existing funds pertaining to the latter work were insufficient. The act also provided for extending the work at the falls so as to include widening and further improvement of the canal above the locks, in accordance with the project submitted in House Document No. 128, Fifty-sixth Congress, second session, but made no additional appropriation therefor.

The river and harbor act of March 3, 1905, authorized the expenditure under continuing contract of $1,020,000 for widening canal as proposed in project submitted in House Document No. 215, Fifty-eighth Congress, third session. Of this $1,020,000 there remains to be appropriated $25,000, and this amount can be profitably expended during the fiscal year ending June 30, 1911, to be applied to rock and earth excavation, concrete revetment walls, timber piers, filling, movable dams, including head gates, and to superintendence and contingencies, all in accordance with project above mentioned.

The river and harbor act of March 2, 1907, adopted a project for the construction of a new lock, with a separate canal, in accordance with "plan 3," set forth in House Document No. 333, Fifty-ninth Congress, second session, at an estimated cost of $6,200,000, of which $1,625,000 has been appropriated and the balance ($4,575,000) authorized to be expended under continuing contract, but not yet appropriated.

During the fiscal year the work of widening the present canal has been continued and 287,163 cubic yards of earth and rock excavated and 2,253 cubic yards of concrete placed in canal walls. A contract for the construction of the superstructure of the movable dam was executed May 8, 1909, but the delivery of the material has not been commenced.

Work on the new lock and canal has consisted in the construction of the cofferdam around the lock pit and the excavation of 97,733 cubic yards on the site of the lock.

The additional appropriation recommended will be applied to lock excavation, pumping, lock masonry, machinery, gates, canal excavation, engineering, office expenses, and contingencies.

The total expenditures to June 30, 1909, under present project for general improvement are $5,021,258.45, of which amount $20,000 was applied to Sailors Encampment, $1,704.22 to expenses of International Waterways Commission, and $86,491.28 to the St. Clair Flats Canal, leaving an unexpended balance of $745,871.74. The balance of the $20,000 diversion ($18,295.78 not included in total expenditures) for International Waterways Commission was transferred to the Commission.

Expenditures to June 30, 1909, for new lock and canal were $202,093.35, leaving an unexpended balance of $1,422,906.65.

The commerce passing the falls during the navigation season of 1908, a period of seven months and twenty-five days, amounted to 41,390,557 tons of freight, valued at $470,141,318. The number of passengers reported during the same period was 53,287.

More detailed information may be found in Annual Report of the Chief of Engineers for 1886, pages 1792 to 1808, and for 1907, page 2034 (historical notes).

CANAL WIDENING, ETC.

July 1, 1908, balance unexpended	$863, 491. 49
Amount appropriated by sundry civil act approved March 4, 1909	225, 000. 00
	1, 088, 491. 49
June 30, 1909, amount expended during fiscal year, for works of improvement	[a] 342, 619. 75
July 1, 1909, balance unexpended	745, 871. 74
July 1, 1909, outstanding liabilities	62, 533. 00
July 1, 1909, balance available	683, 338. 74
July 1, 1909, amount covered by uncompleted contracts	463, 758. 17
Amount (estimated) required for completion of existing project	25, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	25, 000. 00

---

[a] Includes the following accounts paid by Treasury Department:

Account of Duluth, South Shore and Atlantic Railway Company	$5, 985. 86
Account of Michigan Central Railroad Company	13. 02
Account of Minneapolis, St. Paul and Sault Ste. Marie Railroad Company.	208. 20
Transferred to appropriation for survey of Northern and Northwestern Lakes for Poe lock drawings	1, 044. 00
	7, 251. 08

NEW LOCK AND CANAL.

July 1, 1908, balance unexpended	$1,145,712.20
Amount appropriated by sundry civil act approved March 4, 1909	425,000.00
	1,570,712.20
June 30, 1909, amount expended during fiscal year, for works of improvement	147,805.55
July 1, 1909, balance unexpended	1,422,906.65
July 1, 1909, outstanding liabilities	5,164.00
July 1, 1909, balance available	1,417,742.65
July 1, 1909, amount covered by uncompleted contracts	1,772.00
Amount(estimated) required for completion of existing project	4,575,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	1,100,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended	$2,009,203.69
Amount appropriated by sundry civil act approved March 4, 1909	650,000.00
	2,659,203.69
June 30, 1909, amount expended during fiscal year, for works of improvement	490,425.30
July 1, 1909, balance unexpended	2,168,778.39
July 1, 1909, outstanding liabilities	67,697.00
July 1, 1909, balance available	2,101,081.39
July 1, 1909, amount covered by uncompleted contracts	465,530.17
Amount (estimated) required for completion of existing project	4,600,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	1,125,000.00

(See Appendix N N 2.)

3. Operating and care of St. Marys Falls Canal, Michigan.—The former conditions and the results of the improvement are the same as above stated for St. Marys River at the falls.

The service of operating and care is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation under the provisions of section 4 of the river and harbor act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

The total expenditure on this account from 1881, when the Weitzel lock was first put in service, to June 30, 1909 (excluding $8,663.55 outstanding liabilities), amounted to $1,707,734.96, of which $106,514.26 related to operations for the fiscal year.

During the fiscal year ending June 30, 1909, the United States canal was open to navigation two hundred and thirty-eight days, the closed season being from December 14, 1908, to April 19, 1909, inclusive. A total of 11,164 vessels, aggregating 25,481,838 registered tons, and carrying 32,757,486 tons of freight and 23,101 passengers, passed through the locks in 7,671 lockages. The Canadian canal at Sault Ste. Marie, Ontario, open two hundred and thirty-nine days, made 3,894 lockages and passed 5,202 vessels, with an aggregate registered tonnage of 10,772,659, and carrying 14,748,113 tons of freight and 30,912 passengers. The combined traffic through the two canals amounted to 47,505,599 tons of freight and 54,013 passengers.

The principal items of freight during the past fiscal year through both canals were: Iron ore, 29,993,864 tons; coal, 10,482,117 tons; flour, 6,218,237 barrels; wheat, 102,602,007 bushels; other grain, 45,347,674 bushels; lumber, 487,779 M feet b. m.; and general merchandise, 960,256 tons.

Other statistics in relation to this traffic and commerce for the calendar season of 1908 are summarized in the following statements:

Summary of St. Marys River commerce, via American and Canadian canals, during the calendar season of 1908, viz, from April 21 to December 15, 1908, a period of two hundred and thirty-nine days.

Total freight carried, tons	$41,390,557
Total tons net register	31,091,730
Total mile-tons	34,853,548,177
Total valuation placed on freight carried	$470,141,318
Total amount paid for freight transportation	$23,903,244
Total number of registered vessels using canals	806
Total number of passages by unregistered crafts carrying freight	286
Total valuation placed on registered vessels	$111,697,000
Total number of passengers transported	53,287
Average distance freight was carried, miles	842
Average cost per ton for freight transportation	$0.58
Average cost per mile per ton, mills	.69
Average value per ton of freight carried	$11.36
Time American canal was operated, days	231
Time Canadian canal was operated, days	239
Freight carried by—	
Registered vessels, tons	41,368,618
Unregistered vessels, tons	21,939
American vessels, per cent	93
Canadian vessels, per cent	7
Passengers carried by—	
American vessels, per cent	39
Canadian vessels, per cent	61
Average number of vessels passing, per day, through—	
Poe lock	31
Weitzel lock	20
Canadian lock	22
Poe, Weitzel, and Canadian locks	76

Freight traffic by calendar years.

	Tons.		Tons.
1881	1,567,741	1895	15,062,580
1882	2.029.521	1896	16,239,061
1883	2,267,105	1897	18,982,755
1884	2.874.557	1898	21,234,664
1885	3,256,628	1899	25,255,810
1886	4,527,759	1900	25,643,073
1887	5,494,649	1901	28,403,065
1888	6,411.423	1902	35,961,146
1889	7,516,022	1903	34,674,437
1890	9,041,213	1904	31,546,106
1891	8,888,759	1905	44,270,680
1892	11,214,333	1906	51,751,080
1893	10,796,572	1907	58,217,214
1894	13,195,860	1908	41,390,557

For effect of channel improvement on freight rates, see remarks under this head in report of ship channel connecting waters of the Great Lakes between Chicago, Dutluth, and Buffalo.

(See Appendix N N 3.)

4. Hay Lake and Neebish channels, St. Marys River, Michigan.—The original condition of this waterway included rapids and shoals characteristic of St. Marys River, and though passable for small craft having a draft of from 3 to 5 feet, the channel was not navigable in a commercial sense, and the route of vessels through the St. Marys River was by way of Lake George. The water surface, usually varying slowly, may have a rise or fall of 2 feet during a severe storm, and the monthly mean elevation of water surface may change as much as 2 feet in one year, or 4 feet during forty years.

The original project of 1882 contemplated the excavation of channels 17 feet deep and 300 feet wide through all obstructed portions of the Hay Lake route by way of the Middle Neebish, but this project was modified in 1886 to provide a depth of 20 feet and to widen at angles and other critical places, at a total estimated cost of $2,659,115, and the modified project was adopted by river and harbor act of August 5, 1886. The work of improvement was commenced in 1883, under War Department approval of October 27, 1882, and by 1894 work had so far progressed that the route was opened to commerce June 7 of that year, though full width and depth of channel had not been obtained, and since that time several shoals in the deep-water section of the lake have been removed and the dredged channels have been widened at critical places.

The river and harbor act of June 13, 1902, appropriated $500,000 and authorized work up to $4,000,000 more (all of which has been appropriated) for improving Middle and West Neebish channels to provide for the commencement and prosecution of the project outlined in the preliminary report of June 4, 1900 (Annual Report of the Chief of Engineers for 1901, page 3200), and the river and harbor act of March 3, 1905, appropriated $500,000 and authorized work up to $750,000 more for improving Hay Lake and Neebish channels for continuing this improvement, of which $40,000 still remains to be appropriated.

The part of the project outlined in the above-named reports relative to the river below the canal, which has been covered by these two acts, is to provide a channel 1,500 feet wide from the Sault locks to the upper entrance to Hay Lake; to widen and deepen the upper entrance channel into Hay Lake so as to give a least width of 600 feet, with clear depth of 21 feet at low water; to excavate a new channel having least width of 300 feet and low-water depth of 21 feet between Hay Lake and Mud Lake by way of the West Neebish; and to deepen the Middle Neebish channel to give depth of 21 feet at low water, leaving its width unchanged. The effect of the execution of this project will be to provide a clear navigable depth of 21 feet from St. Marys Falls Canal to Lake Huron, the least width being 300 feet where two channels are provided, one for upbound and one for downbound boats, and 600 feet at all other places.

The total amount expended to June 30, 1909, on the Hay Lake and Neebish projects combined was $7,865,066.37.

More extended information, with maps, may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792–1808 (special history), and 1895, pages 2866 and 3052.

During the fiscal year the work on the West Neebish channel was completed and the work of deepening the Middle Neebish channel between Mud Lake and Hay Lake was continued, 1,112,851 cubic yards of earth and rock having been removed.

The funds on hand amount to $504,001.07, and $40,000 additional will be needed for work during the fiscal year ending June 30, 1911, for the prosecution of the authorized improvements.

For statistics of commerce and effects of channel improvements on freight rates, attention is invited to remarks on these subjects in report for operating and care of St. Marys Falls Canal, Michigan, and ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.

MIDDLE AND WEST NEEBISH CHANNELS.

July 1, 1908, balance unexpended	$180,859.23
June 30, 1909, amount expended during fiscal year, for works of improvement	[a] 128,456.27
July 1, 1909, balance unexpended	[a] 52,402.96
July 1, 1909, outstanding liabilities	820.00
July 1, 1909, balance available	51,582.96

HAY LAKE AND NEEBISH CHANNELS.

July 1, 1908, balance unexpended	$620,800.56
Amount appropriated by sundry civil act approved March 4, 1909	395,000.00
	1,015,800.56
June 30, 1909, amount expended during fiscal year, for works of improvement	[b] 567,543.34
July 1, 1909, balance unexpended	[c] 448,625.44
July 1, 1909, outstanding liabilities	91,044.00
July 1, 1909, balance available	357,581.44
July 1, 1909, amount covered by uncompleted contracts	389,418.50
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	40,000.00

(See Appendix N N 4.)

5. *Cheboygan Harbor, Michigan.*—This harbor is at the mouth of the Cheboygan River, where there was an available depth of 6 feet in 1870, when the first project for improvement was made. The original project called for a channel 200 feet wide and 14 feet deep, its sides

---

[a] Of this amount $2,972.67 were expended for light-house work and are chargeable to appropriation "West Neebish lights, St. Marys River, Michigan," leaving the net expenditures $125,483.60, and balance unexpended $55,375.63.

[b] Actual expenditures during the fiscal year were $567,543.34, which amount includes $369.65 chargeable to Isthmian Canal Commission for inspecting material; deducting this latter amount from the total expenditures leaves $567,173.69, net expenditures.

[c] Includes $368.22 refunded by Isthmian Canal Commission.

to be protected by pile revetment and piers, and the estimated cost of the work was $395,335.

Operations under this original project were confined solely to dredging, which was carried to a depth of only 13 feet until 1880, when the first of a series of projects which had for their object the obtaining of a 15-foot channel was submitted, and as a result of the work which was carried on under projects submitted in 1880, 1882, 1887, and 1888 a 15-foot channel was secured from the 15-foot contour in the Straits of Mackinac to the State Road Bridge, having a width of 200 feet from the Michigan Central Railroad dock out into the straits and a width within the river available between piers. A turning basin, with clear 15 feet depth, was also provided in front of the steamboat docks.

There was expended on the original project $90,874.42, and $57,055.02 on the modifications begun in 1880.

Entrance to the channel is marked by a light-house on a crib 40 feet square, which was built in 1881.

The present project was adopted in 1895, and provides for dredging a channel 18 feet deep below the datum plane 581.67 for a width of 200 feet from the 18-foot contour in the Straits of Mackinac to the outer end of the west pier and inside of that point between lines parallel to and 25 feet from the piers to the State Road Bridge. Operations under this project were begun in 1895, and by 1903 the projected channel had been completed to within 900 feet of the upper limit of the harbor, which section still remains to be dredged to complete the project.

It is believed that completion of the 18-foot channel for the above 900 feet will serve no useful purpose, as this part of the river is obstructed by log booms and is not at present available or needed for the general commerce of the harbor. If it is desired to complete the project, an appropriation of $14,000 will be necessary.

The river and harbor act approved March 2, 1907, directed the extension of the improvement from the State Road Bridge to the lock in the Cheboygan River by a channel 8 feet deep and 60 feet wide, the estimated cost of which was $10,797.60.

Work on this extension was begun in October, 1907, and completed in August, 1908.

The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1909, is $41,378.33, none of which has been applied to maintenance. It is proposed to expend the funds on hand in restoring channel depths wherever necessary.

The total length of the dredged channel from deep water in the Straits of Mackinac to the State Road Bridge is 7,900 feet, and from there to the lock is 3,820 feet. The maximum draft that can be carried over the shoalest part of the channel is 17 feet to a point within 900 feet from the State Road Bridge, 10 feet from that point to the bridge, and 8 feet from the bridge to the lock.

Above the lock the river is navigable through what is known as the "Inland Route," through Mullet Lake, Indian River, Burt Lake, Crooked River and Lake, a distance of 36 miles, for boats having a draft of from 4 to 5 feet.

The commerce of the harbor consists mainly of logs, lumber, and ties It amounted to 147,621 tons during the year 1908, and was valued at $698,122. A number of large lake passenger steamers stop at this port during the summer months.

On account of the progressive nature of the improvement, the effect upon freight rates has been gradual, and the precise effect is therefore difficult of ascertainment, but there can be no doubt that during the season of navigation the existence of the deep-water harbor at Cheboygan has had a very decided effect on freight rates.

The Report of the Chief of Engineers for 1896 (pp. 2723, 2724) summarizes the history of operations to June 30, 1896, and the Report for 1895 (p. 2824) gives a map of the harbor.

Reports of examinations and surveys are given in the Reports of the Chief of Engineers, as follows: 1870, page 44; 1871, pages 183–186; 1880, page 2035; 1895, page 2825; 1897, page 2577; 1900, page 4012; and reference on page 664, report of 1906.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	155.898	285.189	1901	161,771	252,727
1894	76.554	227,346	1902	177,231	262,553
1895	110.062	216.868	1903	33,723	259,224
1896	163.362	362,011	1904	24,815	106,461
1897	147,255	293,161	1905	419,171	114,188
1898	366,332	334.636	1906	318,442	141,086
1899	152,689	352,214	1907	444,557	149,211
1900	44,237	59,536	1908	62,054	85,567

July 1, 1908, balance unexpended	$13,478.43
June 30, 1909, amount expended during fiscal year, for works of improvement	4,286.20
July 1, 1909, balance unexpended	9,192.23
Amount (estimated) required for completion of existing project	14,000.00

(See Appendix N N 5.)

6. *Alpena Harbor* (*Thunder Bay River*), *Michigan.*—The original depth of water over the bar at the mouth of the Thunder Bay River was only 7 feet. Local enterprise had secured a narrow channel 12 feet deep through the bar before work was undertaken by the Government in 1877, when, under the original project for the improvement of this harbor, act of August 14, 1876, a channel 13 feet deep and 200 feet wide was secured at a cost of $4,390.48. Shoaling having occurred, in 1882 $15,000 was appropriated for redredging the channel, and the project was modified so as to provide for an available depth of 14 feet. The work was completed the following year at a cost of $10,500, and $3,998.22 was expended in 1889 in redredging to 14 feet across the bar and 13 feet upstream. The amount expended on this project was $14,498.22.

In 1890 the present project was adopted so as to provide for a channel depth of 16 feet below the datum plane 581.5 and the extension of the improvement up the river about a mile to the vicinity of the dam across the river at that point, with widths varying as follows: 200 feet at the 16-foot contour in Thunder Bay, thence tapering to 100 feet at the light-house crib, thence 100 feet to the Second Street Drawbridge, thence 75 feet to the Minor Lumber Company's wharf, thence 50 feet to the upstream limit of the channel improvement, the estimated cost being $36,087.48. This project was completed in

1893. The channel was redredged in 1899, and again in the summer of 1907, a 16-foot depth being provided with a width of 140 feet opposite the light-house, tapering to 100 feet at Second Street Bridge, and to 60 feet for a farther distance of 2,100 feet.

The amount expended on the work of the existing project to the close of the fiscal year ending June 30, 1909, is $36,215.86, of which amount $14,915.39 has been applied to maintenance.

The total length of dredged channel is 6,550 feet, a channel 2,250 feet long and 100 to 200 feet wide having been secured in Thunder Bay, and 4,300 feet long in the river, with widths varying from 100 feet at the light-house crib to 50 feet at the upstream limit of the improved channel. The maximum draft that can be carried over the shoalest part of the channel June 30, 1909, is 13.5 feet. The river is navigable to the upper limit of the improvement only, farther navigation being interrupted by the dam across the river at that point.

The piers at Alpena have been constructed of slabs and have heretofore been held in position by heavy piles of lumber. The timber of this section of the country is rapidly being cut away and the lumber stored is diminishing. As the lumber piles are removed it will be necessary to add sufficient riprap to the outer ends of the slab piers to prevent their destruction by wave action in Thunder Bay. The removal of the lumber is, however, believed to be gradual, and the appropriation recommended is for the purpose of maintaining the piers and any dredging that may be necessary.

The commerce of the harbor consists mainly of lumber, stone, cement, coal, cedar posts and ties, hay and feed, and general merchandise, and amounted to a total of 269,798 tons during the year 1908, valued approximately at $1,913,762.

The effect of the improvement upon freight rates has been very beneficial, as it is estimated that freight and passenger rates have decreased almost one-half since the improvements were made.

A detailed report of operations to that date will be found in the Annual Report of the Chief of Engineers for 1891, pages 2765–2770, and a map showing the locality in the Annual Report for 1889, page 2290.

Reports of examinations and surveys are found in the following Reports of the Chief of Engineers: 1871, pages 158–159, and for 1876, page 106.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	51,600	308,988	1901	62,131	169,442
1894	102,700	363,291	1902	60,213	193,201
1895	35,957	269,203	1903	69,721	153,222
1896	94,067	255,687	1904	51,722	150,381
1897	78,378	293,161	1905	73,331	200,785
1898	60,300	236,075	1906	78,241	171,185
1899	27,888	197,725	1907	419,403	166,116
1900	51,653	263,702	1908	42,035	227,763

July 1, 1908, balance unexpended	$410.00
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	14.56
July 1, 1909, balance unexpended	395.44

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N N 6.)

7. *Saginaw River, Michigan.*—The Saginaw River has a length of about 22 miles, and is formed by the confluence of the Tittabawassee and Shiawassee rivers. Prior to improvement the entrance to the river was obstructed by a bar in Saginaw Bay, having a minimum depth of about 9 feet. Between the mouth and Bay City the depth varied from 15 to 30 feet. Thence to the head of the river the channel was obstructed by a number of bars, having 7 feet of water.

The original project for the improvement of this river was made in 1866, and contemplated a straight channel 195 feet wide and 12 feet deep across the bar at the mouth. This was completed in 1869. In 1874 the project was extended to include the improvement of the river above Bay City. It included dredging a 10-foot channel across the bars at East Saginaw and Carrollton, and the construction of a pile revetment at the latter place. Later, similar improvements at Zilwaukee bar, New York Works bar, and Willow Island were added. The cost of the work under this project was $219,000.

In 1882 the existing project was adopted, which provides for a channel 200 feet wide and 14 feet deep from Saginaw Bay to and along the front of Bay City, and thence a channel of same width, 12 feet deep, to the upper limits of the city of Saginaw, the datum plane being 581.1; estimated cost, $546,000. By the river and harbor act of August 5, 1886, the improvement of the west channel along West Bay City was also added to the project.

The work which was done during the succeeding years resulted in securing a channel of the required depth, but of varying widths. On account of the unstable condition of the channel, it was impossible to complete the project as approved, it being necessary to devote periodically a portion of the funds to restoring the depth through bars in the river, which were formed by the spring freshets, thus leaving insufficient funds to complete the improvement. During 1907 a complete survey of the river was made and plans were formulated to complete the project as far as possible with the funds available. Work was begun in May, 1908, under two contracts, and work under the last contract was still in progress at the close of the fiscal year. A channel 14 feet deep and 200 feet wide was secured from the mouth of the river to Portsmouth bridge in Bay City, and 12 feet deep and 200 feet wide from that point to Michigan Central Railroad bridge in Saginaw; thence to Center Street Bridge being made 150 feet wide and 12 feet deep. The portion from the Michigan Central Railroad bridge to the head of the river has not as yet been completed to the project depth and width. A survey of the bar in the bay was made during the month of May, 1909, and it was found that the dredged channel had filled in considerably at the sides and that dredging was necessary to restore the channel called for by the project. It is proposed to do the work by contract at an early date.

The amount expended on the existing project to June 30, 1909, is $703,156.52. In the past no attempt has been made to separate the cost of maintenance from that of original improvement, so that it is impossible now to separate these items.

The available balance and the additional funds requested will be expended for maintenance of the improved channel and the necessary inspection and engineering.

Saginaw River is navigable for a distance of 22 miles from the mouth.

The volume of commerce benefited by the improvement has been decreasing, due to the decrease in the lumber trade in the Saginaw Valley. The value of the commerce carried in 1908 is approximately $3,735,203, and it consisted mainly of lumber, coal, stone, cement, and salt.

The precise effect of the improvement upon freight rates can not be stated. It is undoubted, however, that freight rates, both to Bay City and Saginaw, have been materially lowered by the existence of the improved channel.

More extended information can be found in the Annual Reports of the Chief of Engineers for 1883, pages 1858–1868; 1885, pages 2138–2150 (with maps); 1890, pages 2724–2729, and 1892, pages 2454–2464.

Reports of examinations and surveys are given in the Reports of the Chief of Engineers, as follows: 1866, page 59; 1867, page 146; 1872, page 207; 1874, pages 206–209; 1875, page 289; 1878, page 1234; 1882, page 2332; 1893, page 2928; 1894, page 2244; 1895, page 2829; 1898, pages 2579, 2600, and 2604.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	651,163	1,069,298	1901	1,250,292	694,741
1894	....	1,108,307	1902	1,012,620	106,409
1895	391,751	347,146	1903	359,779	17,999
1896	471,106	240,496	1904	264,066	13,010
1897	995,960	354,860	1905	227,226	14,161
1898	1,126,891	364,561	1906	274,245	18,860
1899	728,629	311,547	1907	254,897	20,675
1900	482,253	402,827	1908	243,491	21,157

July 1, 1908, balance unexpended		$101,715.04
Amount allotted from appropriation by river and harbor act approved March 3, 1909		25,000.00
		126,715.04
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$54,079.82	
For maintenance of improvement	[a] 27,039.90	
		[a] 81,119.72
July 1, 1909, balance unexpended		45,595.32
July 1, 1909, outstanding liabilities		11,340.08
July 1, 1909, balance available		34,255.24

---

[a] Includes $1.63 expended by Treasury Department, account of Pere Marquette Railroad Company.

July 1, 1909, amount covered by uncompleted contracts	$761.60
Amount (estimated) required for completion of existing project	25,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	25,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N N 7.)

8. *Sebewaing River, Michigan.*—The original channel from Saginaw Bay to the mouth of the Sebewaing River had an available depth of scant 4 feet. The first improvement was made in 1875, under the original project of that year, when a narrow channel 6 feet deep was dredged from the 6-foot curve in Saginaw Bay to the mouth of the river, and some dredging was also done within the river itself, by which it was straightened and deepened to 6 feet, at a cost of $8,000.

The project was modified in 1880, and $7,000 appropriated for deepening the channel to 7 feet, the work being done in 1880–81.

The existing project, adopted in 1896, provides for dredging the entrance channel to a width of 100 feet and depth of 8 feet below the datum plane of the survey of 1895, the length of dredged channel to be about 15,000 feet; estimated cost $37,000; but no work was done until the appropriation of March 3, 1899, became available. Contract was made in 1899 to do the work, which was finished, as far as available funds permitted, September 9, 1903, and resulted in securing a channel of the required length and depth, but with widths varying from 70 to 90 feet throughout the distance covered. The amount expended on this improvement was $35,573.45.

The work which was in progress at the beginning of the fiscal year was continued until August 29, 1908, and resulted in providing a channel about 75 feet wide with a minimum depth of 7 to 8 feet.

The amount expended on the work of existing project to the close of the fiscal year ending June 30, 1909, is $43,992.67, of which amount $8,419.22 has been applied to maintenance.

The maximum draft that can be carried June 30, 1909, at mean low water, over the shoalest part of the locality, is 6.5 feet. The river is navigable to the docks at Sebewaing.

The commerce affected by the improvement amounted in 1908 to 1,325 tons, and consisted mainly of lumber, gravel, fish, and coal. The effect of the project upon freight rates can not be definitely stated, but is considered insignificant.

For reasons stated in his report the district officer does not consider this stream worthy of further improvement.

A map of the locality is given in the Annual Report of the Chief of Engineers for 1903, at page 1988.

Reports of examinations and surveys are given in the following Reports of the Chief of Engineers: 1873, pages 306, 307; 1875, page 290; 1879, page 170; 1880, page 2044; 1891, page 2804; 1893, page 2951; and 1895, page 2743.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1905	4,700	4,350	1907	3,827	412
1906	5,740	4,075	1908	1,014	311

July 1, 1908, balance unexpended	$2,709.99
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,702.66
July 1, 1909, balance unexpended	7.33

(See Appendix N N 8.)

9. *Harbor of refuge at Harbor Beach, Lake Huron, Michigan.*—The site for this harbor, selected in 1872 by a Board of Engineer officers, is on the west shore of Lake Huron, 60 miles north of its outlet into the St. Clair River, and the artificial harbor built there since then is the only safe refuge on that coast from the foot of the lake to Tawas Bay, 115 miles above.

The work of construction was commenced in 1873 under a project providing for three separate piers, or breakwaters, of cribwork filled with stone, so located as to shelter a water area of some 650 acres on the north, northwest, and west sides, and for deepening this area by dredging where necessary. The estimated cost of the breakwaters was $1,452,550, and they were completed in 1885 at a cost of $970,716.40, including maintenance to that date.

The river and harbor act of March 3, 1899, provided for commencing the work of rebuilding the superstructure of the main pier in concrete, and authorized the work to be inaugurated under the continuing-contract system to the extent of $200,000. It was not, however, until 1903 that a definite project for doing the work was decided upon, and the first contract was let in August of that year. The work was begun in June, 1904.

The river and harbor act of March 3, 1905, directed an examination to be made of the harbor, with a view to ascertaining what other further improvements were necessary, if any, in order to make such harbor of refuge suitable for the present demands of commerce. The report, which was submitted to Congress June 16, 1906, and printed as House Document No. 900, Fifty-ninth Congress, first session, recommended the continuation of the rebuilding of the superstructure of the main pier as begun, the rebuilding of the superstructure of the north and south piers in concrete, the protection of the main pier from wave shock by riprap, the closing of the north entrance to prevent the entrance of littoral deposit, and the dredging and deepening of the harbor to 21 feet and of the main entrance to 23 feet. The estimate for the work recommended was $970,000, with an added sum of $10,000 per year for maintenance and harbor police. By the river and harbor act of March 2, 1907, $150,000 was appropriated for continuing this work.

Under this plan for the repair and improvement of the harbor, work on the main pier has been carried on continuously, and was completed in September, 1908.

The total amount expended to the close of the fiscal year ending June 30, 1909, is $1,899,347.89, of which about $975,000 was applied to the first cost of the sheltering breakwaters, which were completed in 1885. Since that time there has been applied to maintenance $924,347.89, which includes the construction of concrete superstructure on main pier, the keeping of the wooden piers in repair, dredging within the harbor, control and berthing of vessels entering the harbor for shelter, and engineering supervision and general office expenses.

The available balance will be applied to covering the cost of the necessary supervision of the harbor during the ensuing fiscal year; also to such repairs to the timber structures as may become necessary.

As a result of the expenditures made upon this harbor, there has been created an artificial harbor of refuge, which has been used for shelter during the past year by 697 vessels, with a total tonnage of 610,886 tons. The grand total of vessels that have found shelter from 1877 to 1908, inclusive, is 37,464, the tonnage of which aggregated 16,583,758. The vessels sheltered in 1877 averaged 289 tons each, and those during the year 1908, 885 tons. The maximum draft that can be carried into the harbor through the main entrance, making allowance for the effect of moderate seas, is between 19 and 20 feet, and vessels having this draft may safely lie inside the main pier.

The appropriation recommended will be applied to continuing reconstruction of the piers.

More extended information can be found in the Annual Reports of the Chief of Engineers for the following years: 1873, pages 292–298; 1877, pages 925–932 (with map); 1879, pages 1645–1648 (with map); 1881, pages 2270–2275; 1882, pages 2369–2372; 1885, pages 2151–2157; 1886, pages 1829–1836.

Reports of examinations and surveys are given in the following Reports of the Chief of Engineers: 1870, page 46; 1871, page 44; 1872, pages 209, 211, and 218; 1895, page 2832; 1896, page 2730; 1897, page 3016; and reference on page 664, report of 1906.

July 1, 1908, balance unexpended	$121,616.88
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	131,616.88
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	104,597.56
July 1, 1909, balance unexpended	27,019.32
July 1, 1909, outstanding liabilities	10,689.00
July 1, 1909, balance available	16,330.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	275,000.00

(See Appendix N N 9.)

10. *Mouth of Black River, Rouge River, and Monroe Harbor, Michigan.*—(a) *Mouth of Black River.*—An extensive bar and shoal exists in the St. Clair River adjoining the mouth of the Black. The bar

lies close to the American side and formerly obstructed the approach to the Port Huron docks, while the shoal, forming a "middle ground" nearly 50 acres in extent, crowded the main channel in a sharp curve close to the Canadian shore.

The original project submitted in 1871 contemplated the removal of this bar and the middle ground to a depth of 15 feet, at an estimated cost of $67,320. The work was begun in 1872 and completed in 1878 at a cost of $56,500.

The present project contemplates dredging to a uniform depth of 16 feet along the dock front of Port Huron from the 16-foot curve above to the same curve below the mouth of the river, the plane of reference being 579.6. Work was begun in May, 1889, and finished in 1892, when authority was received to deepen the outer border of the shoal adjacent to the main channel to 18 feet, and the work was done. The amount expended on this work was $29,348.58. Operations since this time have been confined to maintenance, $12,008.31 having been expended for this purpose since the adoption of the present project to June 30, 1909. The last dredging was done in 1907, when the 16-foot depth was restored.

The available balance will be applied to dredging such portion of the bar as may prove to be obstructive to navigation.

As a result of the work heretofore done, through navigation for vessels of moderate draft has been greatly facilitated, and entrance into the Black River proper has been rendered possible for this class of vessels. This, it is believed, has resulted in a reduction of freight rates, the extent of which could not be ascertained.

Reports of examinations and surveys are given in the following reports of the Chief of Engineers: 1871, pages 177–180; 1887, page 2279; 1899, page 2992; 1900, page 3986.

For receipts by vessel see "Black River at Port Huron," page 774.

July 1, 1908, balance unexpended	$2,643.11
July 1, 1909, balance unexpended	2,643.11

(*b*) *Rouge River*.—This stream originally had a channel depth of from 10 to 17 feet from its mouth to where the Wabash Railroad Bridge crosses it, a distance of about 3 miles.

Under the provisions of the river and harbor act of August 5, 1886, a survey of the river was made and a project, dated August 25, 1888, prepared for securing a channel depth of 16 feet with a width of 240 feet for a distance of 800 feet from the mouth, and thence with a width of 100 feet to the Wabash Railroad Bridge, the plane of reference being 575. The estimated cost was $31,690.39. The work of improvement was commenced in 1888 and completed in November, 1892, at a cost of $30,272.79.

By joint resolution approved April 11, 1898, Congress authorized an extension of the improvement, with depth of 13 feet, up to the Maples road, a distance of about 1½ miles above the Wabash Railroad Bridge, limiting the expenditure to $5,000. The river was dredged in 1900, the channel being made 50 feet wide.

The project for this river was modified by act of March 2, 1907, so as to provide an increase in depth from 16 feet to 21 feet between the mouth of the river and the first bridge, a distance of about 1,400 feet; estimated cost, $3,575.

During the season of 1907 the channel was deepened, in accordance with the amended project, to 21 feet, from the mouth to the Solvay Company's tunnel just below the Detroit connecting railroad bridge.

In addition to this work, the channel depth of 16 feet was restored to a point 11,550 feet above the mouth.

Between May 3 and June 30, 1909, dredging was done under contract and a narrow channel was dredged from the mouth of the river to the Detroit United Railway dock.

The funds recently appropriated for maintenance have only been sufficient to open up a narrow channel. An estimate to fully restore the channel depths and widths of the original project is submitted in the report of the district officer. The appropriation recommended, while considered sufficient for existing commerce, will only partially accomplish this result.

The amount expended on the work of the existing project, as amended, to the close of the fiscal year ending June 30, 1909, is $72,640.68, of which $22,558.19 has been applied to maintenance.

The maximum draft that can be carried June 30, 1909, from the mouth to the Solvay tunnel is 21 feet, from there to the Wabash Railroad bridge 14 feet, from there to the Detroit, Monroe and Toledo Railroad bridge 13 feet, and 10 feet to Maples road. The river is navigable for vessels of light draft to the town of Dearborn, 15 miles above the mouth.

The amount requested will be devoted to maintenance of the channel.

The receipts and shipments by vessel during the year 1908 amounted to 277,746 tons, of which 118,825 tons were iron ore, 64,677 tons lumber, and 30,080 tons pulp wood. The value of this commerce is about $1,505,271.

As a result of the improvement the area available for manufacturing plants in the vicinity of Detroit has been greatly extended, and these plants have been enabled to receive the raw materials which they use without transfer or transshipment. As a consequence the cost of the raw materials has been greatly reduced.

The channel banks of this river are low and ill defined, and as not only the banks, but also the bed, are composed of soft material deterioration of the dredged channel is very rapid. While therefore the growing importance of the industries which rely upon the use of this channel renders it desirable that funds for periodical dredging be provided, it also becomes necessary to demand that the owners of the riparian property, whose value is greatly enhanced by the improvement, shall be called upon to construct proper sand-tight docks. Without such provision recent experience shows that the channel is no sooner dredged than it at once begins to fill up from the material sucked into the channel by the propellers of passing vessels. While therefore the extent of the commerce demands additional depth in the lower portion of the channel, future appropriations should be coupled with the condition that no expenditure be made by the United States until the channel banks within the limits of the improvement have been properly docked.

The effect of the improvement has been to reduce freight rates 30 to 50 per cent for firms actually using dockage on the river.

Reference to report on examination ordered by the river and harbor act of March 3, 1905, will be found on page 664 of 1906 report. More extended information may be found in Annual Reports of the Chief of Engineers for 1890 (pp. 2747–2749); 1899 (p. 3013); 1901 (p. 3155). Reports on examinations and surveys, report for 1887 (p. 2275); 1898 (p. 2605).

Receipts and shipments, by vessel, Rouge River.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	73,732		1901	105,533	782
1894	47,106		1902	56,701	10,000
1895	113,066	1,024	1903	125,272	10,000
1896	120,590	2,905	1904	242,361	6,898
1897	115,987	9,386	1905	284,140	
1898	117,486	10,259	1906	229,861	5,000
1899	92,631	763	1907	248,544	5,000
1900	119,712	4,600	1908	267,746	10,000

July 1, 1908, balance unexpended	$529.04
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	10,529.04
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,479.72
July 1, 1909, balance unexpended	4,049.32
July 1, 1909, outstanding liabilities	2,642.32
July 1, 1909, balance available	1,407.00
July 1, 1909, amount covered by uncompleted contracts	746.79
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	(*a*)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*c*) *Monroe Harbor.*—The harbor of Monroe, Mich., is within the mouth of the Raisin River at the western extremity of Lake Erie. In its natural condition the river flowed into the lake through several ponds and winding creeks. The depth of water at the deepest mouth of the river in its natural condition did not exceed 5 feet.

The original project for the improvement of Monroe Harbor was adopted in 1834. It had for its object to dredge a new and direct channel 100 feet wide and 10 feet deep from the lake across the marsh, a distance of 4,000 feet, to the portion of the river ordinarily used as a harbor, the protection of the entrance into the lake by parallel piers, 726 feet long and 20 feet wide, extending outward to a depth of 10 feet in the lake, and the protection of the sides of the canal by a revetment. The estimated cost of the work, exclusive of dredging machine, was $55,885. The work was practically completed in 1845, a depth of 9 feet being obtained to a point just below the docks at Monroe. Subsequently the city of Monroe further improved the river channel by cutting a canal about 1,300 feet long, 100 feet wide, and with a depth of from 13 to 16 feet, across a bend of the river.

---

[a] See consolidated money statement on page 774.

Subsequent operations consisted in repairing and extending the piers, repairing the canal revetment, and in dredging, by which a channel 200 feet wide and 13 feet deep, extending to deep water in the lake, was obtained.

In 1905 a double line of piling was driven connecting the south pier to the shore, to prevent the lake from breaking through into the canal, and some work was done in replacing rotten deck timbers.

During the summer of 1908 general repairs were made to the piers, placing them in fair condition.

The total amount expended on this work up to the close of the fiscal year ending June 30, 1909, is $260,889.64, of which $110,000 was applied under the original project. It is impossible to separate the portion of this total which has been applied to maintenance. During recent years practically all expenditures have been made for that purpose.

The amount requested will be devoted to maintenance.

The channel, beginning at the outer end, consists of the United States canal, 4,000 feet long, with an available depth of about 11 feet. Three thousand feet farther up the river the Monroe City ship canal begins. This has a length of 1,600 feet and a depth of 10 feet. From the upper end of this canal to the city wharves is 2,600 feet, with a depth of 8.5 feet. The stream is navigable from the lake to the docks at Monroe only, a distance of 2 miles.

This harbor can not accommodate the larger class of vessels used upon the lakes, and its commerce is not large, amounting in the year 1908 to 9,150 tons, valued at $75,000. Of this amount 8,000 tons were sand, the major portion of the balance consisting of fish.

The commerce of this stream is too small to have any effect whatever upon freight rates.

The Annual Report of the Chief of Engineers for 1880, pages 2083 to 2091, gives a detailed history of the operations up to that time.

Reports of examinations and surveys are given in the following Reports of the Chief of Engineers: 1866, page 29; 1868, page 145; 1872, pages 237-239; 1889, page 2338; 1893, page 3048; 1898, page 2689, and 1900, page 4020.

July 1, 1908, balance unexpended	$6,176.08
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	6,050.45
July 1, 1909, balance unexpended	125.63
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

---

[a] See consolidated money statement on page 774.

CONSOLIDATED.

July 1, 1908, balance unexpended	$9,348.23
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	19,348.23
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	12,530.17
July 1, 1909, balance unexpended	6,818.06
July 1, 1909, outstanding liabilities	2,642.32
July 1, 1909, balance available	4,175.74
July 1, 1909, amount covered by uncompleted contracts	746.79
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	21,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N N 10.)

11. *Black River at Port Huron, Michigan.*—In 1888, when the original survey was made, the lower reach of the Black River, from its mouth to the Grand Trunk Railroad bridge, 1½ miles in length, varied in width from 120 to 150 feet and had a depth of from 10 to 14 feet, except at a few points, where it was obstructed by bars having only 8½ feet of water over them. The improvement of this stream was inaugurated by the river and harbor act of September 19, 1890, under a project which contemplated dredging to a navigable depth of 16 feet from the mouth to the Grand Trunk Railroad bridge, with widths varying from 75 feet to 160 feet, at an estimated cost of $75,000. Operations were commenced in 1891 and the dredging was completed June 30, 1894, at a cost of $34,698.65, including an extension upstream of 1,800 feet to Washington avenue, authorized by the act of July 13, 1892. The total length of the dredged channel is 9,700 feet.

Since the completion of the project considerable dredging has been required to maintain the channel, particularly above the Grand Trunk Railroad bridge, where experience and observation show that the narrow dredged channel has no degree of permanence, the last dredging being done in the spring of 1909, when the project depths were restored from the mouth to Washington avenue.

The amount expended for maintenance to June 30, 1909, has been $20,584.91, making total expenditure since adoption of project $55,282.91.

As a result of the work done in this river a channel has been secured 16 feet in depth, with widths varying from 75 feet to 160 feet, extending from the mouth to the Washington Avenue Bridge, a total length of 9,700 feet. The maximum draft that can be carried June 30, 1909, is 15 feet. The river is navigable a considerable distance above Port Huron.

The amount requested will be applied to work of dredging to maintain the improved channel.

There was received during the year 1908, 129,240 tons of freight, valued approximately at $223,407. This consisted mainly of coal, gravel, lumber, and pulp wood.

The effect of the improvement has been to reduce freight rates upon approximately the number of tons received. It is doubtful whether this improvement has any indirect effect upon railroad rates.

More extended information will be found in the following Reports of the Chief of Engineers: 1893, pages 2938–2939; 1894, pages 2251–2252; 1898, pages 2586–2587.

Report of examination and survey is given in the Report of the Chief of Engineers for 1889, page 2292; reports of minor surveys, page 2993 of report for 1899, and page 3988 of report for 1900.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	175,081	7,487	1901	120,018	100
1894	116,535	4,413	1902	123,677	2,600
1895	104,850	6,825	1903	163,265	....
1896	186,987	2,569	1904	197,044	....
1897	96,925	1,455	1905	169,200	....
1898	151,606	16,595	1906	185,695	....
1899	130,675	37,368	1907	168,152	....
1900	105,931	181	1908	129,240	....

July 1, 1908, balance unexpended	$627.94
Amount allotted from appropriation by river and harbor act approved March 3, 1909	4,000.00
	4,627.94
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,910.85
July 1, 1909, balance unexpended	1,717.09
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N N 11.)

12. Operating and care of St. Clair Flats Canal, Michigan.—This canal consists of two dredged cuts through the St. Clair flats at the mouth of the St. Clair River. These cuts have a width of about 300 feet each, and depth of 20 feet, and extend into Lake St. Clair a distance of 17,460 feet. They are separated by a sand dike 100 feet wide, revetted by sheet piling for a distance of 7,221 feet, and the east cut is protected from wave wash and sand drift by a similar dike 50 feet wide.

An historical sketch of the improvement is given on page 2882 of the Annual Report of the Chief of Engineers for 1896, and a description of recent work is given on page 694 of the Annual Report of the Chief of Engineers for 1907.

The care and maintenance of the canal is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation under the provisions of section 4 of the river and harbor act of July 5, 1884, as amended and reenacted by section 6 of the river and harbor act of March 3, 1909.

Operations for the past fiscal year were of the same routine character as those carried on since the opening of the canal to commerce.

A custodian has been present during the year to enforce canal regulations and care for and repair the dikes.

The expenditure to June 30, 1909, was $180,341.97, excluding $357 estimated outstanding liabilities. The amount expended during the year is $11,340.21.

Freight traffic by calendar years:

	Freight tons.
1902	41,773,998
1903	41,888,134
1904	38,044,929
1905	51,359,071
1906	60,589,441
1907	66,271,962
1908	50,586,560

For detailed information of commerce, see statistics appended to report of district officer for improving Detroit River, Michigan (Appendix N N 14). For effect of improvement on freight rates, see remarks in report on ship channel between Chicago, Duluth, and Buffalo (p. 753, *supra*).

(See Appendix N N 12.)

13. Clinton River, Michigan.—This stream empties into Anchor Bay, in the northwesterly part of Lake St. Clair, and before improvement had a channel depth of about 10 feet, except at several shoals, over which but 5 or 6 feet could be carried, and a broad flat at the mouth with a general depth of 3 to 4 feet.

The first appropriation for the improvement of this river was made August 30, 1852, and from that time to 1886 occasional appropriations, amounting in all to $25,500, were made and expended on various dredging projects.

In 1889 a project for the general improvement of the river was adopted, to cover the entire river from the mouth to Mount Clemens, 8 miles upstream. This project called for an 8-foot channel, a pile dike extending across the flat at the mouth to the 10-foot curve in the bay, for revetments as needed above, and for closing the main channel and making a straight cut through Shoemakers bend. The estimated cost was $25,000, revised and amended in 1888 and 1889 to $34,564. The project was completed in 1893 with the expenditure of $34,546.26.

Since the completion of the project there has been $20,125.21 expended for maintenance, making the total expenditure since adoption of present project to June 30, 1909, $54,671.47.

In 1908, an 8-foot depth was dredged between Market and Macomb Street bridges. Periodical dredging is required for maintenance, and the appropriation recommended will be so applied.

As a result of the work done on this river, a channel 8 feet in depth has been secured from the mouth to the city of Mount Clemens, a pile dike has been built along the north side of the outer channel, and revetments have been built where needed in the river above. The present available depth throughout does not exceed 7 feet. The river is navigable for small boats a considerable distance above Mount Clemens. The effect of the improvement on freight rates can not be determined.

There were received and shipped during the year 1908, 27,567 tons of freight, consisting mainly of coal, logs, lumber, and sand. This is valued approximately at $150,000.

More extended information is given in the following Reports of the Chief of Engineers: 1893, pages 2942–2944, and 1894, pages 2254–2255.

Reports of examinations and surveys are given in the Reports of the Chief of Engineers as follows: 1872, page 214; 1876, Part 2, page 549; 1880, page 2062; 1885, page 332; 1895, page 2838; 1899, page 3001, and 1900, page 3996.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1896	30,749	410	1903	28,411	....
1897	29,077	....	1904	22,878	257
1898	29,085	....	1905	41,759	540
1899	35,525	....	1906	25,616	284
1900	32,410	282	1907	23,273	1,033
1901	36,925	....	1908	27,395	172
1902	33,868	....			

July 1, 1908, balance unexpended	$835.28
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	442.75
July 1, 1909, balance unexpended	392.53
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N N 13.)

14. Detroit River, Michigan.—Before improvement the shoalest part of the channel through Detroit River was at Limekiln Crossing, where the normal depth was from 12½ to 15 feet over a bottom of solid rock.

The water surface, usually changing slowly, may rise or fall from a few inches during many days of calm weather to about 4 feet during severe storms and to about 6 feet during short, severe hurricanes, and the monthly mean may change as much as 2 feet in one year, or 4 feet in forty years.

The first project of 1874 provided for a winding channel of at least 20 feet in depth, over 300 feet in width; modified in 1883 so as to somewhat straighten such channel; in 1886 to give 400 feet width; and in 1888 to give 440 feet in width. The general depth above and below the Limekiln was 20 feet or more, but the bed of the river was studded with large bowlders and rocky shoals, which limited the safe navigable depth to scant 15 feet through a distance of about 12 miles. Accordingly the project was modified and extended in 1892 so as to provide for the removal of all obstructive shoals between the city of Detroit and Lake Erie, with a view to obtaining a through channel with a least width of 600 feet and a navigable depth of 20 feet, at a total estimated cost of $1,554,500, as adopted by river and harbor acts of July 13, 1892, and March 3, 1899, and as approved by the War Department at various dates from 1892 up to July 3, 1899. There has been expended on previous projects and modifications thereof $1,554,500.

The present project was adopted by the river and harbor act of June 13, 1902, which provides for a channel 600 feet wide and 21 feet deep from Detroit to Lake Erie. The estimate for the work was increased (see the final report of the survey directed by the act of March 3, 1899, in Annual Report of the Chief of Engineers for 1905, pp. 2292–2296) to $3,750,000, and in accordance with this increase the river and harbor acts of March 3, 1905, and March 2, 1907, authorized the continuation of the improvement to the extent of $700,000 in addition to the $1,750,000 originally authorized. All of this money has been appropriated, but there still remains to be provided for the work $1,300,000. On November 12, 1904, this project was modified to permit of slightly shifting the location of the proposed channel at Bar Point shoals, mouth of Detroit River, without increasing the cost.

The river and harbor act of March 2, 1907, modified the present project so as to provide for two channels—one for downbound, the other for upbound vessels, past Bois Blanc Island. The second channel, called the Livingstone channel (plan B of the report on survey), is to have a least width of 300 feet out to Bar Point, and 800 feet thence to deep water in Lake Erie, with a least depth of 22 feet. Work on this channel is authorized under continuing contracts to the extent of $6,670,950, of which $1,095,950 is yet to be appropriated.

More extended information may be found as follows: Annual Reports of the Chief of Engineers for 1891, pages 2794–2801 (special history); 1896, page 2758 (map), and 1904, pages 3140–3148; also House Document No. 160, Fifty-eighth Congress, second session (main channel to Wyandotte, Mich.), and House Document No. 266, Fifty-ninth Congress, second session (ship channel connecting waters of the Great Lakes).

During the fiscal year work has been prosecuted along Limekiln Crossing range and Hackett range in the Amherstburg channel, and under four separate contracts, each covering one of the four sections of the Livingstone channel. About 70 per cent of the work of improving the Amherstburg channel has been completed and 35 per cent of the Livingstone channel.

There has been expended to June 30, 1909, on the channel now designated as Plan "A," $3,827,683.76, of which amount $2,273,183.76 was applied to the present project, adopted in 1902. The amount expended for Livingstone channel is $2,407,417.01. None of these funds have been applied to maintenance. Upon the completion of the work now under contract and in progress on the channel via Amherstburg, that part of the project will be practically completed, except for the sections along Ballards reef and Bar Point shoals. The work along Ballards reef can not be advantageously done until the completion of the entire Livingstone channel, but as section 4 of the Livingstone channel is now practically completed and open to navigation, work on the Amherstburg channel in this vicinity, the Bar Point section north of Detroit River light-house, will be commenced this season, and $250,000, in addition to available balance, can be profitably expended for this work by June 30, 1911. There has been appropriated

$5,575,000 for the Livingstone channel, and $1,000,000, in addition to available balance, can be profitably expended to June 30, 1911.

The greatest draft which can be carried over the improved channels June 30, 1909, was 22.04 feet, but this is subject to change considerably, the mean monthly stage for November, 1908, having been 20.04 at this place—Ballards reef.

For effect of channel improvements on freight rates see remarks under this head in report of ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo (page 753).

GENERAL IMPROVEMENT.

July 1, 1908, balance unexpended	$307,482.29
June 30, 1909, amount expended during fiscal year, for works of improvement	130,666.05
July 1, 1909, balance unexpended	176,816.24
July 1, 1909, outstanding liabilities	38,762.00
July 1, 1909, balance available	138,054.24
July 1, 1909, amount covered by uncompleted contracts	3,222.00
Amount (estimated) required for completion of existing project	1,300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	250,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

LIVINGSTONE CHANNEL.

July 1, 1908, balance unexpended	$2,061,181.10
Amount appropriated by sundry civil act approved March 4, 1909	3,000,000.00
	5,061,181.10
June 30, 1909, amount expended during fiscal year, for works of improvement	1,893,598.11
July 1, 1909, balance unexpended	3,167,582.99
July 1, 1909, outstanding liabilities	535,770.00
July 1, 1909, balance available	2,631,812.99
July 1, 1909, amount covered by uncompleted contracts	3,003,168.00
Amount (estimated) required for completion of existing project	1,095,950.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	1,000,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

CONSOLIDATED.

July 1, 1908, balance unexpended	$2,368,663.39
Amount appropriated by sundry civil act approved March 4, 1909	3,000,000.00
	5,368,663.39
June 30, 1909, amount expended during fiscal year, for works of improvement	2,024,264.16
July 1, 1909, balance unexpended	3,344,399.23
July 1, 1909, outstanding liabilities	574,532.00
July 1, 1909, balance available	2,769,867.23

July 1, 1909, amount covered by uncompleted contracts	$3,006,390.00
Amount (estimated) required for completion of existing project	2,395,950.00

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	1,250,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix N N 14.)

15. Removing sunken vessels or craft obstructing or endangering navigation.—The following obstructions were completely removed during the fiscal year:

Tug *J. L. Higgie* from channel in Rouge River, Michigan, total cost	$300.00
Steamer *Eliza H. Strong*, in Lake Huron, off Lexington, Mich., total expenditures during fiscal year, $98.49; outstanding liabilities	843.54

The work of removal of wreck of schooner *Harvey Bissell* from Alpena Harbor and of steamer *Iron Age* from Lake Erie will be undertaken during the coming fiscal year.

(See Appendix N N 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE CLEVELAND, OHIO, DISTRICT.

This district was in the charge of Lieut. Col. John Millis, Corps of Engineers. Division engineer, Col. W. L. Fisk, Corps of Engineers.

1. Toledo Harbor, Ohio.—The harbor of Toledo as at present developed extends from the head of Maumee Bay about 7 miles up the Maumee River.

Originally, in the bay, the least depth was at ordinary lake level 8.5 feet, with a prevailing depth of 12 feet, while in the river the minimum depths were 14 feet.

In 1866 a project was adopted to dredge the channels of deepest water in the bay to a depth of 12 feet. The project was amended from time to time until 1887, when the old indirect channel had a minimum depth of 15 feet.

In 1887 a project was adopted for a straight channel through Maumee Bay, with a depth of 17 feet and a bottom width of 200 feet. The estimated cost, including dikes or other channel protections, was $1,875,000.

The project for a straight channel was amended in 1893 by increasing the width of outer section, about 3 miles long, to 300 feet. Since 1892 the improvement has been extended to include the Maumee River.

The total amount expended on original and modified projects prior to operations under existing project is $1,624,695.45.

The present project was adopted by the river and harbor act of March 3, 1899, and is described in the Annual Report of the Chief of Engineers, 1898, pages 2693 to 2705, inclusive. It provides for a channel in the bay and river 400 feet wide and 21 feet deep to Fassett Street Bridge, and 200 feet wide and 21 feet deep for the section above the bridge, with a turning basin 500 feet wide at the upper end. A dike was also to be constructed 1,000 feet in length between the range lights in the bay. The estimated cost of the work was

$1,005,000. A continuing contract was authorized for its execution, the limit of cost being fixed at $950,000.

The work contemplated by this project has been completed with the exception of the channel and basin above the Fassett Street Bridge, where the channel has a width of only 100 feet.

The total expenditure under the existing project to the close of the fiscal year ending June 30, 1909, was $974,187.92, of which amount $141,215.58 was for maintenance during the past six years.

The deepening of the channel in the bay to the Wheeling and Lake Erie Railroad bridge was done under contract, and the deepening of the river above by the U. S. dredge *Maumee*. The dredging under this contract was completed October 9, 1905, a total of 5,854,456 cubic yards having been removed.

During the past year the U. S. dredge *Burton* excavated 145,760 cubic yards of material from the Maumee River between its mouth and the Pennsylvania Railway bridge and 16,971 cubic yards of material from the outer division of the bay channel, all at a cost of $15,669.95.

Dredging in the northerly 200 feet of the bay channel was carried on under three contracts, all dated September 2, 1908.

Under the first of these contracts 78,596 cubic yards of material was removed from the inner division, the work being completed November 4; 12,270 cubic yards additional was removed from this division between November 5 and November 13 under a subsequent agreement with the contractor.

The second contract was for dredging in the middle division. The amount removed was 80,727 cubic yards. The contract was completed November 13.

The third contract was for dredging in the outer division; 69,508 cubic yards of material was removed up to November 14, when the contract was completed.

The result of these expenditures has been to create and maintain a channel through Maumee Bay and River 400 feet wide and 20 feet deep to Fassett Street Bridge, a distance of 15 miles, and to a width of 100 feet and depth of 20 feet for 1 mile above this bridge. The Maumee River is also navigable for launches to Perrysburg, 15 miles above the mouth.

The appropriation recommended will be applied toward maintenance of existing channel to keep the improvement available.

The usual variations in the level of the water surface during the season of navigation range from 1 foot above to 2 feet below mean lake level. Extreme fluctuations, due to wind, of 7.9 feet above to 7.1 feet below mean lake level have, however, been observed at Toledo.

There has been a marked reduction in freight rates since the project was inaugurated, but this has been due not only to the work at this particular harbor, but to that at the other harbors along the lakes and the improvements in the connecting channels, as well as to other causes, and it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Toledo for the calendar year 1908 amounted to 3,946,819 tons, a decrease of 1,131,056 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended	$73,091.80
Amount allotted from appropriation by river and harbor act approved March 3, 1909	45,000.00
	118,091.80
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	71,165.17
July 1, 1909, balance unexpended	46,926.63
July 1, 1909, outstanding liabilities	1,794.88
July 1, 1909, balance available	45,131.75
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	45,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 1.)

2. *Port Clinton Harbor, Ohio.*—The harbor of Port Clinton is within the mouth of the Portage River. This river flows into Lake Erie at a point about 13 miles by land and 22 miles by water west of the city of Sandusky. In its natural condition the depth of water on the bar at the mouth of the river rarely exceeded 5 feet at ordinary lake level.

The original project for its improvement was adopted in 1871 and was slightly modified in 1872 and 1873. It provided for the construction of two parallel jetties extending outward from the mouth of the river to a depth of 10 feet in the lake, at an estimated cost of $90,000. These were built of timber and stone.

The jetties were extended to a depth of 10 feet in the lake in 1883, at which time the east jetty had been extended 2,180 linear feet and the west jetty 1,948 linear feet. These lengths were thought sufficient for the requirements of this harbor, and in 1894, at which time a total expenditure of $71,949.86 had been made, it was recommended that the remainder of the estimated cost of executing the project ($21,000) be expended for necessary repairs.

The project since 1894 has been one for maintenance, under which $30,104.82 has been expended.

The result of these expenditures has been to produce a channel about 10 feet in depth, extending for one-half mile above the mouth of the Portage River, which was the maximum draft that could be carried June 30, 1909. A channel of 6 feet depth extends to Oak Harbor, 12 miles above the mouth of the river.

The appropriation recommended will be applied to maintenance to keep the improvement available.

The project has had little effect on freight rates, as the commerce of the port is small.

No work under contract has been done at Port Clinton during the year.

The commerce of Port Clinton for the calendar year 1908 amounted to 13,068 tons, an increase of 2,217 tons over that reported for the calendar year 1907.

July 1, 1908, balance unexpended	$0.71
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,500.00
	2,500.71
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	55.39
July 1, 1909, balance unexpended	2,445.32
July 1, 1909, outstanding liabilities	45.00
July 1, 1909, balance available	2,400.32
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	1,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 2.)

3. *Sandusky Harbor, Ohio.*—The harbor of Sandusky is in the lower part of Sandusky Bay, along the city front, the part nearest to the lake being about 2 miles from the bar which divides the waters of the bay from those of the lake. In its natural condition the depth was only such as the bay afforded, which was about 10 feet along the city front and from 9 to 12 feet thence to the lake, at ordinary lake level.

A long, flat sand bar divided the bay from the lake, this bar being cut through by a channel from 1,000 to 2,000 feet in width near its central portion. The southern part of the bar is called "Cedar Point" and the northern "Sand Point." Between these two points the currents between the bay and the lake had scoured out the channel to a depth of not less than 18 feet for a distance of a mile or more.

The first appropriation was made for a survey in 1826, and the first improvement was made in 1844, consisting in the construction of a dam to close a breach across Sand Point. With this exception, all the improvements made previous to 1896 consisted in deepening natural channels and in making a new straight channel from the city front to Cedar Point and in removing sand and bowlders from the dock channel along the city front. Natural causes since 1826 have washed away a greater part of Sand Point.

In 1896 and subsequently the project was added to so as to provide for the construction of parallel jetties of stone upon mattress foundations extending from Cedar Point and Sand Point outward, with a view to confining and directing the flow of water to and from the bay. Provision was also made for the construction of certain spurs and mattresses for the protection of the channel near Cedar Point and at the point of the bar near the light-house.

Under the original project thus modified there was expended $477,149.09.

The present project, authorized by the river and harbor act of March 3, 1899, is described in the Annual Report of the Chief of Engineers for 1898, pages 2708 to 2716, inclusive. It provides for an east jetty of stone upon brush mattresses extending from Cedar Point about 5,000 feet into the lake; for a west jetty 5,500 feet long on the opposite side of the channel, about 750 feet distant; for the protection of the crest of the bar and shore of Sand Point with a low dam of brush and stone, and for a deflecting dike for inner bar 1,500 feet long and dredging to 17 feet. The estimated cost was $425,796, of which $317,796 was for permanent works. By the river and harbor act of June 13, 1902, the project was modified so as to provide for dredging a channel 21 feet deep at mean lake level with a width of 400 feet in the approaches to the harbor front and 300 feet in the harbor channel, at an estimated cost of $781,000, as described in the Report of Chief of Engineers, 1901, pages 3270 to 3277, inclusive. The estimated cost of the entire project as revised in 1903 was $1,135,000.

The act of March 3, 1905, modified the project by omitting therefrom the excavation of rock other than that already provided for by contract in the dock channel and fixed the limit of expenditures at $815,000. Continuing contracts in excess of cash appropriations were authorized by the same act to the amount of $480,000, of which $130,000 remains to be appropriated. The act of March 2, 1907, restored this work of rock removal to the project and appropriated $125,000 for maintenance and continuing the improvement. In the interim the city of Sandusky had removed considerable rock from the channel.

The total expenditures under the present project for improving Sandusky Harbor to June 30, 1909, is $602,004.90, of which amount $27,403.48 was for maintenance during the past six years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

Under the appropriation of $125,000 in the river and harbor act of March 2, 1907, a contract is in force for the removal of rock in the dock channels. During the past year under this contract there has been removed 93,387 cubic yards of material. A portion of the rock removed was deposited in the extension of the east jetty, where it can be used for the building up of this protection. The U. S. dredge *Burton* worked in the outer channel from November 25 to December 4, removing 16,907 cubic yards of material at a cost of $1,055.92.

The result of these expenditures has been to create a channel 300 feet wide and 21½ feet deep through the outer bar, 400 feet wide and 20½ feet deep to the city front, and 160 to 300 feet wide and 20 feet deep along the city front to the Short Line docks, completing 99 per cent of the work now under contract. The project as a whole is regarded as about 70 per cent completed.

There is at present, however, some shoaling which reduces the available width to a minimum of 200 feet through the outer bar and to a minimum of 250 feet in the channel between the outer bar and the city front.

The appropriation recommended will be applied to maintenance to keep the improvement available.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

There is a general depth of 10 feet in Sandusky Bay to the mouth of the Sandusky River, 14 miles above the city, and of 8 feet in the river to Fremont, Ohio, 18 miles above its mouth, but there is practically no navigation above Sandusky. The usual variation in the level of the water surface is the same as at Toledo, with extreme fluctuations of 5 feet above and below mean lake level.

The receipts and shipments at the harbor of Sandusky for the calendar year 1908 amounted to 1,295,474 tons, a decrease of 944,387 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$281,416.83
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$65,650.80	
For maintenance of improvement	2,728.02	
		68,378.82
July 1, 1909, balance unexpended		213,038.01
July 1, 1909, outstanding liabilities		8,341.22
July 1, 1909, balance available		204,696.79
July 1, 1909, amount covered by uncompleted contracts		11,167.65
Amount (estimated) required for completion of existing project		135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix O O 3.)

4. Huron Harbor, Ohio.—This harbor is situated at the mouth of Huron River. In its natural condition the entrance was practically closed by a sand bar.

The first project for its improvement was adopted in 1826 and provided for the construction of two parallel jetties 140 feet apart, extending outward from the river banks. These jetties were lengthened from time to time and repaired as required, and the channel was finally deepened by dredging.

The total amount expended upon these projects for all purposes of construction and maintenance to June 30, 1905, was $269,789.07.

The present project for the improvement of this harbor was authorized by the river and harbor act of March 3, 1905. It is based upon a survey, plan, and estimate called for by the river and harbor act of June 13, 1902, and is published in full in the Report of the Chief of Engineers for 1904, pages 3209 to 3218, inclusive.

It provides for rebuilding 580 feet of the west jetty, extending it 240 feet, and constructing a pierhead 50 feet square at its outer end; for a second pierhead of the same dimensions and 300 feet easterly from it; for a jetty or breakwater extending from this east pierhead to a point on shore 1,200 feet easterly from the channel; for the removal of the old east jetty; and for the dredging of the channel and a part of the sheltered area to a depth of 21 feet below mean lake level.

In the spring of 1904 it was necessary to make an allotment of $40,000 from the river and harbor act of April 28, 1904, for the maintenance of this harbor. This money has been expended in rebuilding about 490 linear feet of the shoreward end of the west jetty, which was in such a ruinous condition that it threatened to give way and to involve the destruction of the channel. This extension directly advanced the project and diminished proportionally the amount required for its completion.

The river and harbor act of March 3, 1905, appropriated $68,500 and authorized contracts to be entered into for $200,000 more for the completion of the new projects. Of this latter sum all but $3,000 has now been appropriated.

The work contemplated in the latest project has been completed, with the exception of a small amount of dredging in the sheltered area.

The excavation necessary in connection with the execution of the project and for maintenance of channel has been done during the past year by the U. S. dredge *Maumee;* 65,986 cubic yards of material was removed from the sheltered area, at a cost of $10,632.95.

The amount expended under the existing project to June 30, 1909, was $248,461.68, of which amount $10,471.31 was for maintenance.

The result of these expenditures has been to obtain a channel 200 feet wide and 21 feet deep at mean lake level through the outer bar and jettied channel for a distance of three-fourths of a mile. The project is regarded as 99 per cent completed.

A channel 8 feet deep extends to Milan, 8 miles above the mouth, but there is practically no navigation on this part of the river.

The appropriation recommended will be applied to maintenance to keep the improvement available.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce for Huron Harbor for the calendar year 1908 amounted to 1,167,574 tons, a decrease of 1,153,881 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$57,315.09
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$9,599.66	
For maintenance of improvement	7,165.80	
		16,765.46
July 1, 1909, balance unexpended		40,549.63
July 1, 1909, outstanding liabilities		442.70
July 1, 1909, balance available		40,106.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix O O 4.)

5. Vermilion Harbor, Ohio.—Vermilion Harbor is at the mouth of Vermilion River, which empties into Lake Erie about 20 miles eastward from Sandusky.

The improvement of this harbor was first undertaken in 1836, when an appropriation of $10,000 was made for the purpose. The original project provided for parallel jetties extending outward to 12 feet of water in the lake. The jetties were built, but the current only sufficed to maintain a channel of about 7 feet depth across the bar at ordinary lake level.

In the natural condition of the harbor there was only about 2 feet of water at this place. Dredging was accordingly resorted to and the project enlarged to provide for a depth of 14 feet of water. This involved the removal of rock, and the project was never fully executed.

The total amount of money expended on the original project is $133,277.55.

No work has been done under contract at Vermilion during the past year.

The amount expended on the existing project for maintenance to June 30, 1909, was $29,964.13.

The result of these expenditures has been to provide a channel 12 feet deep to the inner end of the piers. A channel of 8 feet extends to the Lake Shore Railway bridge, one-half mile above. The water-surface fluctuations are similar to those at Huron or Lorain.

The appropriation recommended will be applied to maintenance to keep the improvement available.

The improvement has had little effect on freight rates, as the tonnage of the port is small.

The receipts and shipments for the calendar year 1908 amounted to 1,355 tons, a decrease of 254 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended	$155.82
Amount allotted from appropriation by river and harbor act approved March 3, 1909	2,000.00
	2,155.82
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	119.95
July 1, 1909, balance unexpended	2,035.87
July 1, 1909, outstanding liabilities	.40
July 1, 1909, balance available	2,035.47
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	1,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 5.)

6. *Lorain Harbor, Ohio.*—This harbor is within the mouth of Black River, where it enters Lake Erie, 25 miles west of Cleveland. In its natural condition the depth of water at the mouth of this river at ordinary lake level did not exceed 3 feet, but the river itself was navigable for a distance of 3 miles from its mouth for all vessels then in use upon the lake.

The first project, adopted in 1828, provided for the construction of parallel piers 200 feet apart, running out to a depth of 16 feet in the lake. This project was modified in 1873 and 1880. The piers have been rebuilt and extended from time to time, to keep pace with increasing requirements, and dredging has been resorted to to secure a greater depth than the natural currents would afford. The amount expended on this project was $292,202.88.

The present project was adopted by the river and harbor act of March 3, 1899. The project in detail is given in full in the Annual Report of Chief of Engineers for 1898, pages 2718 to 2724, inclusive. It provides for the construction of two rubble-mound breakwaters converging toward the lake, having an opening between them at their outer extremities 500 feet in width and in prolongation of the axial line of the jettied channel. It also provides for repairing the jetties and for dredging the protected areas to a depth of 20 feet. The estimated cost is $695,500.

The total expenditure authorized by the river and harbor act of March 3, 1899, was $650,000, but that amount not being sufficient to secure the completion of the work at such prices as could be obtained by advertisement, special authority was given in the river and harbor act of June 6, 1900, to enter into contract for such portion of the work as the funds available would allow, at a cost not to exceed a 10 per cent increase over the original estimates, and the funds required therefor were appropriated in the river and harbor act approved March 3, 1905, and sundry civil acts of March 3, 1905, and June 30, 1906. The act of March 2, 1907, authorized the expenditure of $15,000 in dredging the easterly side of Black River from the inner end of the easterly government pier to East Erie Avenue Bridge.

The river and harbor act of March 3, 1909, provided for the expenditure of funds already appropriated or authorized for the extension of the west arm of the breakwater to or toward the shore.

Under various contracts the east and west piers have been entirely rebuilt, two breakwaters have been built, the western one 1,800 feet long, the eastern one 1,500 feet long, and pierheads have been constructed at the entrance of the outer harbor.

There has been expended under the new project to June 30, 1909, $652,637.40, of which amount during the past six years $27,971.58 was for maintenance. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

With this expenditure a channel has been dredged to a depth of 20 feet between the piers and for 1,000 feet beyond. The east pier, 1,003.5 feet long, and the west pier, 1,765 feet long, have been entirely rebuilt. The east pierhead and east breakwater were completed August 4, 1908, providing a west breakwater 1,800 feet long and an east breakwater 1,500 feet long, with pierheads at their outer extremities.

The U. S. dredge *Maumee* was engaged from July 17, to September 3 in dredging the easterly side of Black River from the inner end of the government pier to the East Erie Avenue Bridge under a project approved March 27, 1907; 41,760 cubic yards of material was removed, at a cost of $4,901.91.

The project is 95 per cent completed. A channel 21 feet deep below mean lake level also extends up the river to the steel plant, 3 miles above the mouth, and is maintained by local authorities.

The appropriation recommended will be applied to maintenance to keep the improvement available.

The water-surface fluctuations are similar to those at Cleveland.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Lorain for the calendar year 1908 amounted to 4,399,350 tons, a decrease of 331,070 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$154,120.84
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$28,707,80	
For maintenance of improvement	6,968.95	
		35,676.75
July 1, 1909, balance unexpended		118,444.09
July 1, 1909, outstanding liabilities		93.51
July 1, 1909, balance available		118,350.58
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix O O 6.)

7. *Cleveland Harbor, Ohio.*—Originally Cleveland Harbor was simply the mouth of Cuyahoga River, in which the water was shoal and sometimes the entrance was entirely closed to boats by the sand. The first improvement was undertaken in 1825, and the plan contemplated straightening the channel and making it permanent by side jetties. The channel was dredged when necessary. The total expenditure under this plan was $346,244.84.

In 1875 a project was adopted for a breakwater of timber cribs in 5 fathoms of water. The west breakwater was commenced in 1876 and completed in 1883, a total length of 7,130 feet. The east breakwater was commenced in 1888 and continued at intervals until 1893, when its length was 2,494.5 feet. In 1895 an opening of 200 feet was made in the shore arm of the west breakwater as a sanitary measure.

In 1896 Congress authorized the completion of the improvement at a total estimated cost not to exceed $1,354,000, in accordance with a project published in Annual Report of the Chief of Engineers for 1896, pages 2949 to 2953, inclusive. This project involved the completion of the east breakwater, covering an extension of about 3,000 feet; removing superstructure of the old west breakwater to a depth of 2 to 3 feet below water level and replacing it with a superstructure of concrete masonry; reenforcing the cribs below the masonry; sheathing the face of the east breakwater; removing and rebuilding the east and west piers and widening the mouth of the river. A continuous contract for the work was authorized.

In 1899 a project was prepared, and was authorized by the river and harbor act of that year, for deepening the channel and sheltered area by dredging to a depth of 21 feet. This project was enlarged by the act of June 13, 1902, to permit the dredging to be carried to a depth of 25 feet. The estimated cost of the work was $478,400. (See Annual Report of the Chief of Engineers for 1899, pp. 3076 to 3078, inclusive, for project, and p. 3061 for estimate as revised.)

The river and harbor act of June 13, 1902, authorized a further modification of the project by providing for improving and enlarging the entrance to the harbor and for extending the breakwater eastward to Gordon Park, in the city of Cleveland, a distance of about 16,000 feet, at a total estimated cost of $4,481,456. This project is described in the Annual Report of the Chief of Engineers for 1901, pages 3277 to 3299, inclusive. The act authorized an expenditure of

$2,800,000, of which $100,000 is yet to be appropriated, but this authorization was increased by $900,000 in the river and harbor act of March 2, 1907, of which $600,000 is yet to be appropriated. This act also appropriated $98,000 for the construction of a Government dock at the foot of Erie street in the city of Cleveland, in accordance with plan printed in House Document No. 270, Fifty-ninth Congress, second session, contingent upon the consent of the Cleveland Yacht Club, which holds a lease of this frontage.

The existing project for improving Cleveland Harbor, Ohio, is therefore a combination of those authorized by the acts of 1875, 1896, 1899, 1902, and 1907.

There has been expended on this project to June 30, 1909, $5,523,698.53, of which amount $508,259.72 was for maintenance during the past six years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

With this expenditure the mouth of the river has been widened, the east and west piers rebuilt and capped with concrete, with the exception of a small amount of jetty extension and dredging near the mouth of the Cuyahoga River and south of the Lake Shore Railway bridge, which has not been carried out because the United States has been unable to obtain title to the land which would have to be dredged away. The superstructure of the west breakwater has been removed and replaced by concrete masonry, and the lake face of the cribs protected with riprap. The old east breakwater has been repaired and extended as provided for in the project of 1896, with the exception of about 270 feet, which, being a portion of the shore arm, was not built on account of the modifications in the river and harbor act of June 13, 1902, which rendered its construction unnecessary.

The work at the new entrance was completed October 6. This consists of two pierheads, two projecting breakwaters, and rubble-mound protection for the old structure. The western division of the east breakwater extension was completed October 27, 1908, the eastern division is 85 per cent complete, and work under a contract dated January 14, 1909, for the new extension eastward is 18 per cent complete.

Construction of the wharf at the foot of East Ninth street was commenced June 1, 1909.

From 1899 to 1904, 766,928 cubic yards of material was excavated in the harbor, at a cost of $115,000; but, as shown by the annual report of the district engineer for 1904, the deposit which took place over this area during this period has equaled or exceeded the amount of material removed, and the work done therefore must be regarded simply as maintenance work and not in advancement of the project.

A contract for dredging in the basin was completed November 24. Under this contract 801,628 cubic yards of material was removed.

As a result of these expenditures a navigable channel 25 feet in depth has been provided at the mouth of the river and a large outer harbor constructed which is available for docks and anchorage. The project as a whole is regarded as 80 per cent completed.

The amount recommended to be appropriated will be applied to building pierheads, east entrance, and shore arm of the east breakwater.

Cuyahoga River has a navigable depth of 20 feet to Jefferson street, 4 miles above its mouth, and 16 feet for 1½ miles farther, and is maintained by local authorities.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce for Cleveland Harbor for the calendar year 1908 amounted to 10,159,170 tons, a decrease of 2,713,278 tons from that reported for the calendar year 1907.

The usual variation in the level of the water surface during the season of navigation is from 1 foot above to 2 feet below mean lake level. Fluctuations due to wind are about 2 feet.

UNDER CONTRACTS, ETC., AUTHORIZED BY ACT OF JUNE 3, 1896.

July 1, 1908, balance unexpended	$45,484.84
July 1, 1909, balance unexpended	45,484.84

MAINTENANCE (DREDGING) AND CONTINUING IMPROVEMENT.

July 1, 1908, balance unexpended	$104,791.17
June 30, 1909, amount expended during fiscal year, for works of improvement	47,007.48
July 1, 1909, balance unexpended	57,783.69
July 1, 1909, outstanding liabilities	23.96
July 1, 1909, balance available	57,759.73
Amount (estimated) required for completion of existing project	203,000.00

WHARF ROOM.

July 1, 1908, balance unexpended	$98,000.00
June 30, 1909, amount expended during fiscal year, for works of improvement	57.08
July 1, 1909, balance unexpended	97,942.92
July 1, 1909, outstanding liabilities	171.20
July 1, 1909, balance available	97,771.72
July 1, 1909, amount covered by uncompleted contracts	83,735.00

NEW ENTRANCE, BREAKWATER EXTENSION, ETC., ACTS OF JUNE 13, 1902, AND MARCH 2, 1907.

July 1, 1908, balance unexpended	$672,040.99
Amount appropriated by sundry civil act approved March 4, 1909	337,500.00
	1,009,540.99
June 30, 1909, amount expended during fiscal year, for works of improvement	472,029.04
July 1, 1909, balance unexpended	537,511.95
July 1, 1909, outstanding liabilities	55,194.15
July 1, 1909, balance available	482,317.80

July 1, 1909, amount covered by uncompleted contracts	$1,010,433.09
Amount (estimated) required for completion of existing project	1,481,456.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 194,000.00

CONSOLIDATED.

July 1, 1908, balance unexpended	$920,317.00
Amount appropriated by sundry civil act approved March 4, 1909	337,500.00
	1,257,817.00
June 30, 1909, amount expended during fiscal year, for works of improvement	519,093.60
July 1, 1909, balance unexpended	738,723.40
July 1, 1909, outstanding liabilities	55,389.31
July 1, 1909, balance available	683,334.09
July 1, 1909, amount covered by uncompleted contracts	1,094,168.09
Amount (estimated) required for completion of existing project	1,684,456.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 194,000.00

(See Appendix O O 7.)

8. *Fairport Harbor, Ohio.*—This harbor is situated at the mouth of Grand River, 30 miles east of Cleveland. Before the improvement was undertaken the depth across the bar at the mouth of the river was variable.

The first improvement was undertaken in 1825, and the original project provided for the construction of parallel jetties of cribwork filled with stone, placed about 200 feet apart and extending outward across the bar and into the lake. The jetties were extended from time to time until the west jetty attained a length of 2,370 feet and the east jetty 1,765 feet from the original shore line. These jetties have been repeatedly repaired and rebuilt as necessities required, and the channel has been deepened and dredged many times.

By the river and harbor act of June 3, 1896, the existing project for this improvement was adopted. This project is described in the Report of the Chief of Engineers for 1896, pages 2956 to 2958, inclusive, and provides for the construction of two breakwaters converging toward the lake, the outer ends being in deep water, and sufficient space being left between them to afford an easy entrance to the jettied channel. The breakwaters were to terminate in pierheads 50 feet square, the west breakwater to have a length of 2,050 feet and the east breakwater 1,350 feet. The estimated cost of the work, including dredging between the breakwaters to a depth of 20 feet, was $510,000, which was revised to $585,000 in 1900. (See Annual Report of the Chief of Engineers for 1900, pp. 4071–4072.)

---

[a] Of this amount, $100,000 is under the continuing-contract authorization made in the river and harbor act approved June 13, 1902, and $94,000 under act of March 2, 1907.

A further modification of the project occurs in the river and harbor act of March 3, 1905, which provides that the westerly arm of the breakwater may be extended to a point at or near the shore, the expense thereof to be paid from the appropriations therein and theretofore made. The estimated cost of this extension was $120,000.

The total expenditures to June 30, 1899, on the original project, were $368,940.09.

The river and harbor acts of June 13, 1902, and March 3, 1905, provided not only for continuing existing project but for maintenance of the old work. From the various appropriations since 1899 there have been expended $196,167.25 in repairs to old piers and dredging. With these funds 580 linear feet of the shoreward end of the east jetty was completely rebuilt of timber cribs with a concrete top, and 570 linear feet of the west jetty was extensively repaired with tongued and grooved piling below the water and with concrete and stone above, and the outer portion of both jetties was protected below water by a sheathing of hard-wood plank, and the wooden superstructure was completely repaired.

With the funds available for continuing the improvement, 828 linear feet of the shoreward end of the west breakwater, as provided for in the report of 1896, has been built, extending to the shore. The work of extending the west breakwater 1,000 feet lakeward and for the construction of a pierhead at its outer end is in progress under contract. This work is about 65 per cent complete.

There has been expended on the existing project to June 30, 1909, $504,540.89, of which amount $125,358.32 was for maintenance during the past six years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

The water surface variations are similar to those of Cleveland.

The amount recommended to be appropriated will be applied to building the east arm outer breakwater.

The result of these expenditures has been to obtain a channel 20 feet deep at mean lake level across the bar at the mouth of the river and to protect the entrance from westerly storms. The project is regarded as about 55 per cent completed.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Fairport Harbor for the calendar year 1908 amounted to 2,302,275 tons, a decrease of 1,021,220 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$155,614.63
Amount allotted from appropriation by river and harbor act approved March 3, 1909		5,000.00
		160,614.63
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$74,929.20	
For maintenance of improvement	2,850.26	
		77,779.46
July 1, 1909, balance unexpended		82,835.17
July 1, 1909, outstanding liabilities		13,190.09
July 1, 1909, balance available		69,645.08

July 1, 1909, amount covered by uncompleted contracts	$61,636.82
Amount (estimated) required for completion of existing project	245,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	245,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix O O 8.)

9. *Ashtabula Harbor, Ohio.*—This harbor is situated at the mouth of the Ashtabula River 56 miles east of Cleveland. In its natural condition the mouth of the river was obstructed by a bar upon which the depth of water varied according to weather conditions. The greatest depth on the bar that could prevail was 9 feet, at ordinary lake level, this being the distance to the underlying rock near the shore line.

The original project for the improvement of this harbor was adopted in 1826 and provided for the construction of two parallel jetties extending outward into the lake. These jetties have been built and repaired from time to time and extended farther into the lake, and the channel has been deepened by dredging to meet the increasing demands of commerce, the project being modified accordingly.

The total amount expended on the original project was $565,192.27.

The existing project was adopted under the authority of the river and harbor act of 1896 and is described in the Report of the Chief of Engineers for 1895, pages 3122 to 3216, inclusive, and provides for the construction of two breakwaters, each 1,500 feet long, and two pierhead cribs, at an estimated cost of $465,000. This plan was modified as explained in the Annual Report of the Chief of Engineers for 1896, pages 2963 and 2964, to provide a west breakwater 1,800 feet long and an east breakwater 1,200 feet long.

The river and harbor act of March 3, 1899, authorized a continuous contract to be made for the construction of these breakwaters, at a cost not to exceed $430,000.

The river and harbor act of March 3, 1905, authorized the expenditure of the unexpended balance on hand to the credit of the improvement for the extension of the west breakwater to a point at or near the shore, and the funds have been applied toward the prolongation of the west breakwater 1,300 feet.

Work under a contract for constructing the east and west breakwaters was completed August 17.

Bids have been received for a further extension of the west breakwater and for necessary reenforcement to the timber crib portion of that structure.

The amount expended on the existing project to June 30, 1909, is $757,209.84, of which amount $20,897.77 was for maintenance during the past six years. Prior to that time the amounts expended for works for improvement and for maintenance were so involved that it would be impracticable to separate them.

The project is regarded as 95 per cent complete.

In 1904 the Secretary of War, under authority of law, gave permission to the Pittsburgh, Youngstown and Ashtabula Railroad Company to completely remove the west jetty and to replace the same by a bulkhead 60 feet farther to the west, thus increasing the width of the channel.

A description of this improvement is contained in the Annual Report of the Chief of Engineers for 1908, page 758.

In May, 1906, authority was also granted by the Secretary of War to the Lake Shore and Michigan Southern Railway Company to make certain improvements on the easterly side of the river. The railway company has taken possession of the east pier and extended it northward 720 feet; thence it is extended about 900 feet easterly; thence southward, meeting the property of the railway company. The inclosure, about 15 acres, has been filled to the level of the docks, about 3,350 feet of crib dock has been completed, and a second fill of 20 acres to eastward has been built up. The government east breakwater affords but partial protection to these new docks. The railroad company has been authorized to extend the east breakwater to protect its docks. Work on this improvement was begun in June, 1906, and 1,100 feet of the breakwater is completed. The east basin and slip have been dredged to a depth of 23½ feet.

As a result of these expenditures the depth across the bar at the mouth of the river has been increased to 20 feet and an outer harbor has been provided. A 20-foot channel extends up the river 1½ miles above its mouth and is maintained by the local authorities.

The appropriation recommended will be applied to maintenance to keep the improvement available.

The water-surface variations are similar to those at Cleveland.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Ashtabula Harbor for the calendar year 1908 amounted to 5,935,097 tons, a decrease of 5,899,483 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$145, 217. 24
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$62, 017. 88	
For maintenance of improvement	2, 775. 11	
		64, 792. 99
July 1, 1909, balance unexpended		80, 424. 25
July 1, 1909, outstanding liabilities		182. 64
July 1, 1909, balance available		80, 241. 61
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		5, 000. 00

(See Appendix O O 9.)

10. Conneaut Harbor, Ohio.—Conneaut Harbor is at the mouth of Conneaut Creek, 69 miles east of Cleveland. In its natural condition the creek was obstructed by a bar at its mouth, over which the average depth of water did not exceed 2 feet at ordinary lake level.

The first improvement was undertaken in 1829, and consisted in the construction of parallel jetties of timber cribs filled with stone. The greatest depth obtained under this project did not exceed 12 feet.

No appropriations were made for this harbor from 1880 to 1892. At the end of this period the jetties were in a decayed and ruinous condition, and the channel had filled up with sand and silt, and had practically reverted to its original condition. The harbor could only be used by small sailing craft, such as were then engaged in fishing.

In 1892 a project was prepared which provided for the construction of parallel jetties 200 feet apart and extending outward to a depth of 17 feet in the lake, and appropriations under this project were made to 1896.

Expenditures on the early projects were $192,448.47.

The existing project was authorized by the river and harbor act of June 3, 1896, and is described in the Annual Report of the Chief of Engineers for 1896, pages 2970–2972, inclusive. This project provides for the completion of the jetties to a depth of 17 feet in the lake, and the construction of two detached breakwaters converging toward the lake and designed to shelter the entrance to the jettied channel, and for securing a navigable depth of 20 feet in the channel and sheltered area. The estimated cost of the work was $610,000, exclusive of maintenance.

The total amount expended on the existing project to June 30, 1909, is $644,424.48, of which amount $31,601.23 was for maintenance during the past six years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

With these funds the project has been completed.

From April 30 to May 22 the United States dredge *Burton* worked at Conneaut restoring the channel to its usual depth and width, some shoaling having occurred during the winter months.

As a result of these expenditures the depth across the bar at the mouth of the creek has been increased to 20 feet and an outer harbor has been provided. A 20-foot channel extends up the creek one and one-half miles above its mouth, and is maintained by local authorities.

The water surface variations are similar to those at Cleveland.

The appropriation recommended will be applied to maintenance to keep the improvement available.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce for Conneaut Harbor for the calendar year 1908 amounted to 6,468,064 tons, a decrease of 1,883,343 tons from that reported for the calendar year 1907.

July 1, 1908, balance unexpended		$60,394.47
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$18,876.19	
For maintenance of improvement	5,841.01	
For Isthmian Canal Commission	[a]807.73	
		25,524.93
July 1, 1909, balance unexpended		34,869.54
July 1, 1909, outstanding liabilities		113.27
July 1, 1909, balance available		34,756.27

---

[a] To be refunded.

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	$5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 10.)

11. *Removing sunken vessels or craft obstructing or endangering navigation.*—(*a*) *Schooner Lillie.*—This vessel while unloading gravel at the east pier, Cleveland Harbor, north of the custom-house, was collided with by another vessel, disabling her to such an extent that she was beached immediately north and west of the Lake Shore Railway bridge in such a position as to obstruct the movements of the draw span. The wreck was immediately removed from this location by the use of a tug, which hauled her clear of the draw. The cost of this work was $40.15, paid from an allotment made August 14, 1908, under provisions of section 20, river and harbor act of March 3, 1899.

(*b*) *Sand sucker Syracuse.*—This sand sucker struck a sunken pile in Swan Creek in Toledo Harbor, Ohio, turned turtle, broke in two, and sunk in the channel, August 26, 1908. A dipper dredge was employed to remove the wreck, which she did at a total cost of $340, paid from an allotment for the purpose made October 30, 1908, under provisions of section 20, river and harbor act of March 3, 1899.

(See Appendix O O 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE BUFFALO, NEW YORK, DISTRICT.

This district was in the charge of Col. W. L. Fisk, Corps of Engineers, division engineer, Lakes Division, having under his immediate orders First Lieut. W. L. Guthrie, Corps of Engineers, since March 23, 1909.

1. *Harbor at Erie, Pa.*—In its original condition the harbor of Erie was nearly landlocked, the only entrance being at the east end through a channel which was narrow and tortuous, variable in position, with a depth of about 6 feet.

The original project approved March 26, 1824, provided for closing the eastern end of the harbor by means of a breakwater, in which there should be an opening 200 feet wide, and for extending to deep water in the lake two parallel piers, one on each side of the opening. The project also included the necessary work of dredging to keep the channel open, making the necessary repairs to existing structures, and maintaining the Presque Isle Peninsula.

The project was modified by the river and harbor act of March 3, 1899, to require the harbor basin and entrance channel to be dredged to a depth of 20 feet at mean lake level, the north and south piers to be provided with concrete superstructure and extended 500 and 1,000 feet, respectively, and, conditionally, as stated in House Document No. 70, Fifty-fifth Congress, first session, four protection jetties to be built along the outer shore of Presque Isle Peninsula.

The estimated cost of completing the modified project was $377,000.

At the beginning of the past fiscal year, under the modified project, 1,210 feet of wooden superstructure on north pier had been replaced with concrete; the north pier had been extended 510 feet and the south pier 500 feet; two protection jetties had been built; the channel and basin dredged 20 feet deep, except the shoal area along the harbor line, abreast and west of the public dock, which will be dredged this season, and the wooden superstructure on all of the south pier (1,217 feet) had been replaced with concrete.

During the fiscal year a further extension of the south pier, 500 feet, was completed; a survey of the entrance channel and harbor basin was made. Specifications prepared and bids invited, to be opened July 15, 1909, with a view to making contract for restoring project depths. Project completed except maintenance; a further dredging of harbor basin, and building two jetties on the north shore of Presque Isle Peninsula, provided for conditionally.

Work proposed for the ensuing fiscal year includes doing dredging necessary to maintain the project depth in entrance channel and basin, to maintain existing structures, and to protect Presque Isle Peninsula when necessary, all for the purpose of making the improvement available and for extension of benefits.

The total amount expended on the harbor to June 30, 1909, was $1,364,146.49. It is impracticable to separate the cost of construction and maintenance. The project is about 95 per cent completed.

The maximum draft that could be carried June 30, 1909, at mean lake level over the shoalest part of the locality under improvement was 19 feet, and the usual variation of level of water surface is about 2 feet.

The following table gives the total arrivals and departures, including tonnage, for the past ten years:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1899	3,200	3,961,794	1904	1,996	2,890,321
1900	2,709	3,403,312	1905	2,632	4,134,459
1901	3,405	3,204,325	1906	2,579	4,477,764
1902	2,809	3,873,734	1907	2,927	5,504,896
1903	2,423	3,503,628	1908	2,093	3,690,578

For more extended information and photographs, see Annual Report of the Chief of Engineers for 1900, page 4100 et seq., and for 1903, page 2115 et seq.; for list of surveys, see page 3239, Annual Report of the Chief of Engineers for 1897. Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 770 of report for 1908.

A chart of Erie Harbor is issued in the series of charts of the Survey of the Northern and Northwestern Lakes, index 332.

July 1, 1908, balance unexpended	$113,934.64
June 30, 1909, receipts from sales	1.33
	113,935.97
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	45,200.18
July 1, 1909, balance unexpended	68,735.79

(See Appendix PP 1.)

2. *Harbor at Dunkirk, N. Y.*—This is an artificially protected harbor lying in an indentation of the south shore of Lake Erie, between

Point Gratiot on the west and Battery Point on the east. The distance between these points is 9,600 feet, and the maximum breadth of the indentation is 3,600 feet.

The original depth of water was about 10 feet at mean lake level and 15 to 16 feet to underlying rock.

The project, approved November 30, 1870, provided for a detached breakwater 2,860 feet long, one part of which, 2,300 feet long, was to be nearly parallel with the shore; the other part, 560 feet long, to be nearly parallel with the axis of the entrance channel.

This breakwater and the pier already built, 1,410 feet long, were to form the harbor, and the old channel was to be enlarged to 170 feet wide and 13 feet deep.

The project adopted by Congress and provided for by the river and harbor act of June 3, 1896, consisted in completing the breakwater as before planned by the addition of 360 feet to its eastern end and adding the channel arm 560 feet long, and in addition thereto dredging the entrance channel and a harbor basin, containing in all about 65 acres, to a depth at mean lake level suitable for vessels drawing 16 feet. This work was completed in 1898 at a total cost of $389,060.55.

The total amount expended on the harbor to June 30, 1909, was $983,014.22. It is impracticable to separate the cost of construction and maintenance.

During the fiscal year repairs to structures damaged by storm of January 20, 1907, were completed at a total cost of $16,235.65.

Work proposed for the ensuing fiscal year consists in placing the structures in as good repair as practicable with the funds on hand.

The maximum draft that could be carried June 30, 1909, at mean lake level over the shoalest part of the locality under improvement was 16 feet, and the usual variation of level of water surface is about 2 feet.

Freight rates have not been affected by the project.

The following table gives the total arrivals and departures, including tonnage, for the past ten years:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1899	192	82,783	1904	117	5,128
1900	278	107,316	1905	115	9,502
1901	171	49,148	1906	111	11,310
1902	143	33,435	1907	97	5,712
1903	237	64,803	1908	117	3,422

For more extended information and map, see Annual Report of the Chief of Engineers for 1898, page 2748 et seq., and for reports of surveys, see page 3127, Annual Report of the Chief of Engineers for 1896, and page 4150, Annual Report of the Chief of Engineers for 1900. Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 770 of report for 1908.

A chart of Dunkirk Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 318.

July 1, 1908, balance unexpended	$6,236.42
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	11,236.42
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,033.26
July 1, 1909, balance unexpended	7,203.16

(See Appendix PP 2.)

3. *Harbor at Buffalo, N. Y.*—Buffalo Creek was the original harbor of the port of Buffalo. In its original condition the entrance channel from the lake was shallow and frequently closed by a gravel bar. The original project for the improvement of this harbor was adopted in 1826, and provided at first for the construction of piers on the north and south sides of Buffalo Creek. Subsequently, a masonry sea wall, 5,400 feet long, was built along the lake shore south of the harbor entrance, and a sand-catch pier of piles and stone, 879 feet long, built out from the shore.

Between 1868 and 1893 a detached breakwater, 7,600 feet long, was built of timber cribs about a half mile distant from the lake shore and parallel with it.

A shore arm about 4,000 feet long was projected in 1874 to extend to the south end of this breakwater, leaving an opening of 150 feet. Work on this was in progress when it was wrecked by storm in 1893.

A new project was adopted in 1895 on the recommendation of a board of engineer officers and consisted of the abandonment of the shore arm and the extension of the breakwater to Stony Point.

The report of the Board and details of its plans are published in the Annual Report of the Chief of Engineers for 1895, page 3153 et seq. The river and harbor act of June 3, 1896, added to the project of the Board by providing for the construction of a farther length of the sand-catch pier, extending it to the established pierhead line.

The river and harbor acts of June 6, 1900, and June 13, 1902, made special provision for deepening the entrance to Buffalo Harbor and the city ship canal. The entrance channel has been dredged 23 feet deep at mean lake level for a width of 200 to 300 feet for 2,200 feet outward from outer end of north pier, 150 feet wide between the piers to its inner end (junction of Buffalo River and city ship canal), except over an area of rock at that point, where the depth is from 21½ to 23 feet.

The project now in force for the improvement of Buffalo Harbor, adopted June 3, 1896, and modified by the emergency river and harbor act of June 6, 1900, and the river and harbor acts of June 13, 1902, March 3, 1905, and March 2, 1907, is as follows:

(*a*) To build an extension of the breakwater to Stony Point, leaving the necessary openings for the convenience of commerce.

(*b*) To extend the sand-catch pier to the established pierhead line.

(*c*) To build an arm 1,000 feet long to the Stony Point section of breakwater for the purpose of protecting the south harbor entrance.

(*d*) To maintain existing structures by strengthening timber-crib concrete portions and by making repairs and replacing the wooden superstructure of the breakwater with concrete and stone when necessary, and to maintain the north entrance channel 23 feet deep at mean lake level.

(*e*) To dredge to a depth of 23 feet at mean lake level an area at south end of harbor sufficient to provide access to canals of Lackawanna Steel Company and Buffalo and Susquehanna Iron Company.

(*f*) To remove to a depth of 23 feet a shoal outside the main or north entrance to the harbor.

Of the above, items (*a*) and (*b*) have been completed, (*c*) is now in progress, (*d*) will be required indefinitely, (*e*) is completed, and it is expected to complete (*f*) during the present season.

During the fiscal year work on the south entrance arm has been continued; about 750 feet is 70 per cent completed, and a contract has been made for constructing the remaining 250 feet.

Work of repairing damage by storm of January 20, 1907, to 1,910 feet of old breakwater has been continued during the fiscal year, and fair progress made, 61 per cent completed.

Work of removing shoals outside main entrance to harbor has progressed very slowly and time limit for completion of contract has been waived, the contractor to pay the extra expenses incurred by reason of waiver. At the close of the fiscal year the work was 50 per cent completed. It is expected it will be completed this season.

During the fiscal year 3,281 tons of heavy riprap stone was placed on and along the Stony Point section—timber crib—at a cost of $4,530.12.

Work proposed for the ensuing fiscal year, for making improvements available, and for extension of benefits, consists in continuing work on south entrance arm, removing shoal outside of north entrance to harbor, repairing timber portions of breakwater, and general maintenance of channels and structures.

It is recommended that the project be enlarged to include the removal of additional shoals outside the north or main entrance to the harbor.

The total amount expended by the United States on the improvement of Buffalo Harbor to June 30, 1909, was $5,426,720.59. It is impracticable to separate the cost of construction and maintenance.

A good harbor has been obtained. The principal features are north and south piers and the entrance channel between them at the mouth of Buffalo Creek, in which most of the business of the port is done, and the outer breakwater system, consisting of four sections of breakwater of an aggregate length of 22,600 feet, inclosing an outer harbor 4½ miles long and over one-half mile wide. This breakwater system comprises 8,894 linear feet of breakwater of timber-crib-concrete type, 7,250 linear feet of stone or rubble-mound type, 723 feet of timber-crib-stone type, 1,910 linear feet of wrecked timber-crib-rebuilding to timber-crib-stone type, and 3,823 feet of timber-crib type.

The maximum draft that could be carried June 30, 1909, at mean lake level over the shoalest part of the locality under improvement was 20 feet. The usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The commerce of Buffalo is large. During the year 1908 arrivals and departures of vessels by lake and river aggregated in number 6,191 and in tonnage 12,003,968.

The arrivals and departures of canal boats by the Erie Canal were 4,482 in number, with a tonnage of 1,621,527.

The principal receipts by lake and river were wheat, corn, flour, oats, iron ore, lumber, copper, pig iron, glucose, lard, and pork. The total receipts amounted to 7,526,615 tons.

The shipments by lake were principally coal, sugar, salt, and cement, and aggregated 4,652,259 tons.

For comparison the following table is given, showing the arrivals and departures by lake and canal and the tonnage for the past five years:

Year.	Lake.		Canal.	
	Number.	Tons.	Number.	Tons.
1904	7,375	10,783,980	5,132	988,725
1905	7,950	12,090,153	4,902	985,861
1906	8,294	13,876,759	5,606	1,769,919
1907	8,205	14,578,233	5,014	1,942,455
1908	6,191	12,178,874	4,482	1,621,527

Total shipments and receipts: 1907, 18,429,695 tons; 1908, 13,800,401 tons.

For more extended information and maps and photographs, see Annual Reports of the Chief of Engineers since 1897, and for reports of surveys see page 3153, Report of Chief of Engineers for 1895, and reference on page 703, Report of Chief of Engineers for 1906, printed in full in House Document No. 240, Fifty-ninth Congress, first session.

A chart of Buffalo Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 312.

July 1, 1908, balance unexpended		$558,836.28
June 30, 1909, receipts from sales and collections		471.80
Amount transferred from appropriation for Buffalo entrance to Erie Basin and Black Rock Harbor		3,264.44
		562,572.52
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$48,067.19	
For maintenance of improvement	110,134.96	
		158,202.15
July 1, 1909, balance unexpended		404,370.37
July 1, 1909, amount covered by uncompleted contracts		236,727.16

(See Appendix P P 3.)

4. Lake Erie entrance to Black Rock Harbor and Erie Basin, New York.—The adopted project contemplates the formation, by dredging and rock removal, of a channel 2,300 feet long, 400 feet wide, and 23 feet deep at mean lake level, except where bed rock is found at a depth of 22 feet, from Buffalo main entrance channel to Erie Basin, and a branch channel and basin 1,920 feet long, 500 feet wide, and 23 feet deep at mean lake level, to Black Rock Harbor, at an estimated cost of $814,643. In its original condition there was a depth of from 12 to 18 feet at mean lake level. The act of June 13, 1902, authorized the letting of a continuing contract in the sum of $614,643, exclusive of amount appropriated, for completing the work.

The plan of improvement is printed in House Document No. 125, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 3345.

The work was begun April 30, 1903, under a continuing contract for the whole work, to be completed under certain conditions of contract on or before December 31, 1906.

The work was not completed on that date, and the time limit was waived for a reasonable period, the contractor to pay the extra expense incurred by reason of the extension of time.

The work was completed December 31, 1908, at a cost of $814,643, this being the total amount expended to June 30, 1909, for work of improvement.

The maximum draft that could be carried over the shoalest part of the locality under improvement at mean lake level June 30, 1909, was 21 feet, and the usual variation of level of water surface from 3 to 4 feet, with maximum variation much greater.

For commercial statistics, see report on Buffalo Harbor, New York.

The locality is shown on a chart of Buffalo Harbor and Niagara River to the falls, issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 312, and on an index map facing page 2142, Annual Report of the Chief of Engineers for 1903.

Reference to survey is made on page 592, Annual Report of the Chief of Engineers for 1900.

The project, being auxiliary to the improvement at Buffalo, has not, as a separate work, affected freight rates.

July 1, 1908, balance unexpended	$173,028.09
June 30, 1909, amount expended during fiscal year, for works of improvement	173,028.09

(See Appendix P P 4.)

5. Buffalo entrance to Erie Basin and Black Rock Harbor, New York.—The first appropriation, $50,000, for this improvement was made March 3, 1899, and an appropriation of $191,701.25 was made June 6, 1900, to complete the work.

The adopted project is to build a breakwater about 2,200 feet long, covering and protecting the entrance to Erie Basin and Black Rock Harbor and the lake front of Buffalo Harbor between the State structures known as the "Erie Basin breakwater" and the "Bird Island pier," which in their original condition were unprotected from storms.

The amount expended to June 30, 1909, was $238,436.81, of which $236,278.10 was for constructing and $2,158.71 was for maintenance. No money was expended during the past fiscal year as the project is completed.

The maximum draft that could be carried over the shoalest part of the locality under improvement at mean water level June 30, 1909, was 20 feet, and the usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

For commercial statistics, see report on Buffalo Harbor.

For more extended information, see Annual Reports of the Chief of Engineers for 1897, page 3246 et seq., and for 1901, page 3324 et seq., and for report of survey see page 3246, Report of the Chief of Engineers for 1897.

The locality is shown on a chart of Buffalo Harbor and Niagara River to the falls, issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 312, and on an index map facing page 2143, Annual Report of the Chief of Engineers for 1903.

The project, being auxiliary to the improvement at Buffalo, has not, as a separate work, affected freight rates.

This breakwater is the most northerly section of the breakwater system protecting Buffalo Harbor. The river and harbor act of March 3, 1909, reappropriated the funds on hand, for improving harbor at Buffalo, N. Y., and the breakwater will hereafter be maintained, and reports made, under the latter appropriation.

July 1, 1908, balance unexpended	$3,264.44
Transferred to Buffalo appropriation	3,264.44

(See Appendix P P 5.)

6. *Black Rock Harbor and channel, New York.*—Black Rock Harbor is in reality a canal built along the east bank of Niagara River, separated therefrom by Bird Island pier and Squaw Island, and having at its lower end a lock of 5 feet lift, 36 feet wide by 200 feet long, and a depth of 9½ feet on miter sills at mean lake level. This harbor, or canal, was separated from the Erie Canal by a wall of stone and earth, and was constructed as a terminal for the Erie Canal.

From 1829 to 1834 appropriations amounting to $52,098 were made by the United States and applied to the construction of the Bird Island pier or breakwater.

The object of the present project is to provide a channel for deep-draft vessels between Buffalo and Tonawanda around the rapids at the head of Niagara River. This is to be accomplished by making a channel 200 feet wide and 23 feet deep at mean lake level, joining at the foot of Maryland street, Buffalo, the 23-foot channel completed in 1908, the proposed channel to extend westerly and northerly, through Black Rock Harbor and Erie Canal combined, to the present lock, below which a ship lock of the requisite capacity is to be built, the channel to extend from the foot of the ship lock through the Niagara River to deep water above Tonawanda, 400 feet wide and 23 feet deep at mean river level. The estimated cost is $4,500,000. The project contemplated a lock 600 feet in length and 60 feet in width between quoins; but in order to accommodate vessels of the largest size now in use and under construction which may desire to use it the dimensions of the lock have been increased to 650 feet in length and 70 feet in width.

Report of survey is printed on page 3284 et seq. of report for 1904.

Lands and structures needed in the prosecution of the work have been granted to the United States by the State of New York.

Continuing contracts were authorized by the river and harbor acts of March 3, 1905, and March 2, 1907, in the sum of $2,700,000 (all of which has since been appropriated) for prosecuting the project, and such contracts have been made as follows:

For the excavation of the southerly 6,400 feet, more or less, of the channel, to be completed December 31, 1908.

For the excavation of the next northerly 3,400 feet, more or less, of the channel, to be completed December 31, 1910.

For the construction of concrete walls for the ship lock, to be completed June 30, 1912.

During the fiscal year the cofferdam for lock walls was completed, unwatered, and excavation therein to bed rock nearly completed, and channel excavation was continued under existing contracts.

The total amount expended to June 30, 1909, was $991,390. The project is about 20 per cent completed.

The appropriation recommended will be applied toward payments under existing contracts, to construction of lock gates and machinery, and to further prosecution of the project, including construction of a bridge at Ferry street, Buffalo, and the excavation of the east channel of the Niagara River from the foot of the ship lock to the natural deep water harbor 2½ miles down stream. It is recommended that the entire amount ($1,800,000) required to complete this project be made available, $1,000,000 by cash appropriation for the year ending June 30, 1911, and $800,000 by continuing contract authorization.

The maximum draft that could be carried June 30, 1909, at mean lake level, over the shoalest part of the locality under improvement, was 8 feet, and the usual variation of water surface is from 3 to 4 feet.

The project, being auxiliary to the improvement at Buffalo, has not, as a separate work, affected freight rates.

The locality is shown on United States Lake Survey Chart No. 312.

For commercial statistics see report on Buffalo Harbor and on Tonawanda Harbor and Niagara River, New York.

July 1, 1908, balance unexpended	$1,469,662.35
June 30, 1909, receipts from sales	1.00
Amount appropriated by sundry civil act approved March 4, 1909	1,000,000.00
	2,469,663.35
June 30, 1909, amount expended during fiscal year, for works of improvement	708,633.10
July 1, 1909, balance unexpended	1,761,030.25
July 1, 1909, amount covered by uncompleted contracts	1,451,760.75
Amount (estimated) required for completion of existing project	1,800,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	1,000,000.00

(See Appendix P P 6.)

7. *Tonawanda Harbor and Niagara River, New York.*—In its original condition the navigation of Niagara River from Lake Erie to Tonawanda was obstructed by several reefs and shoals which materially limited the draft of vessels traversing it, and the river in some places had a very swift current. The water in the harbor between Tonawanda Island and the mainland was shoal.

The adopted project of April 11, 1888, as modified June 3, 1896, and June 13, 1902, is to remove obstructions, so as to make a channel 400 feet wide and 18 feet deep at mean river level from Lake Erie to the north line of North Tonawanda, including the dredging of Tonawanda Harbor to a depth of 18 feet.

The river and harbor act of March 2, 1907, also appropriated $3,000 for removing wreck of steamer *Embury* from Niagara River, near Grand Island.

The project is completed except at the Buffalo waterworks intake pier, where the width of the channel is about 100 feet, and from the Tonawanda Iron and Steel Company's docks to the north line of North Tonawanda, where the depth is from 12 to 15 feet.

The amount expended to June 30, 1909, was $661,671.45, all for improvement.

No work was done during the fiscal year; $7.30 expended for traveling expenses.

No work is proposed for the ensuing fiscal year.

The commerce of Tonawanda is large. During the year 1908 there were entered and cleared 1,048 lake craft, with a tonnage of 742,408 tons. The receipts were principally lumber, iron ore, and limestone, and aggregated 734,255 tons. The shipments from Tonawanda are entirely by Erie Canal.

The maximum draft that could be carried June 30, 1909, at mean water level, over the shoalest part of the locality under improvement, was 15 feet, and the usual variation of level of water surface is 2 feet.

A chart of Niagara River to the falls is issued in the series of charts of Northern and Northwestern Lakes, index 312.

It is reported that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

For reports of surveys see page 2066, Annual Report of Chief of Engineers for 1888, and page 4155, report for 1900.

July 1, 1908, balance unexpended	$30,230.68
June 30, 1909, receipts from collections	49.07
	30,279.75
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	7.30
July 1, 1909, balance unexpended	30,272.45

(See Appendix P P 7.)

8. *Removing sunken vessels or craft obstructing or endangering navigation.*—The scow *Trader* sunk in Niagara River off the east shore of Strawberry Island July 8, 1908, and was abandoned by her owners.

Under allotment of $2,000 made August 18, 1908, the wreck was removed at a cost of $830 and the balance of funds returned to the Treasury November 16, 1908.

(See Appendix P P 8.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE OSWEGO, NEW YORK, DISTRICT.

This district was in the charge of Col. W. L. Fisk, Corps of Engineers, division engineer, Lakes Division, having under his immediate orders First Lieut. W. L. Guthrie, Corps of Engineers, since March 23, 1909.

1. *Harbor at Charlotte, New York.*—This harbor is at the mouth of the Genesee River. In its original condition vessels of more than 8 feet draft could not cross the bar.

The original project of 1829 was to secure a channel 12 feet deep across the bar by constructing parallel piers to confine and direct the action of the spring freshets. The project of 1882 was to obtain a depth of 15 feet by extending the two piers a total of 3,250 feet and by dredging. After the piers had been extended 1,444 feet the project was modified July 18, 1896, to preserve the depth by dredging without further extension of the piers for the present, and March 2, 1897, it was again modified to obtain and maintain not less than 16 feet and not more than 16½ feet at low water (zero of Oswego gauge) in a channel not more than 200 feet wide.

The piers are nearly parallel, about 450 feet apart. The west pier is 3,616 feet and the east pier 3,109 feet in length, projecting beyond the shore line 2,230 and 2,200 feet, respectively. During the fiscal year 812 feet of the east pier and 59 feet of the west pier received concrete superstructure, making a total to June 30, 1909, of 1,532 feet of east and 1,559 feet of west pier with concrete superstructure. The entrance channel was maintained during the year. Project completed except maintenance.

The amount expended to June 30, 1909, was $750,987.25. It is impossible to separate the cost of construction and maintenance.

June 30, 1909, the maximum draft that could be carried in the channel at low water was 16 feet, and the usual variation of level of water surface is 3 feet.

The Genesee River is navigable for lake vessels for a distance of about 2½ miles above its mouth.

It is reported that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of the commerce at this port during the past ten years, in tons: 1899, 447,428; 1900, 388,605; 1901, 549,207; 1902, 557,690; 1903, 569,169; 1904, 554,212; 1905, 597,996; 1906, 432,709; 1907, 701,916; 1908, 709,950.

The work proposed for the ensuing fiscal year, to make the improvement available, is to make necessary repairs to piers and to dredge the channel when required, and the appropriation recommended will be applied to this purpose, with the allotment of $9,000, made from emergency funds May 24, 1909.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2436.

A chart of Charlotte Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 241.

July 1, 1908, balance unexpended	$37,166.32
Allotted from emergency appropriation, act of March 3, 1905	9,000.00
Sales	4.10
	46,170.42
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	36,500.41
July 1, 1909, balance unexpended	9,670.01
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	80,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix Q Q 1.)

2. Harbor at Pultneyville, N. Y.—This harbor is at the mouth of Salmon Creek, which empties into Lake Ontario in Wayne County, N. Y. In its original condition the depth was only 20 inches.

The original project in 1871 was to protect the approach to the creek by building two piers in the lake, of timber cribs filled with stone, and to dredge a channel from the 10-foot curve in the lake to the mouth of the creek to a depth of 10 feet at low water, at an estimated cost of $59,000.

In 1875 the material to be dredged was found to be so hard that the estimated cost was increased to $71,000.

The project is completed, except that a depth of 8 feet instead of 10 feet was obtained, the effort to secure the latter having been abandoned in 1900 on account of the difficult dredging.

The piers are 220 feet apart in their parallel portions. The west pier is 910 feet long and the east pier 572 feet long. The west pier extends out in the lake 300 feet farther than the east pier.

No work was done at this harbor between 1900 and 1907, there being no funds available.

An appropriation of $6,000 was made by the river and harbor act of March 2, 1907, for work at this harbor, and project for general repairs to piers, filling space between inner end of east pier and shore with stone, and removing about 7,500 cubic yards sand, etc., from channel was approved March 18, 1907.

During the fiscal year minor repairs were made to the piers, at a cost of $677.31.

The amount expended to June 30, 1909, was $83,265.15, of which $70,607.96 was for construction and $12,657.19 for maintenance. The project is completed except maintenance.

June 30, 1909, the maximum draft that could be carried in the channel was 7 feet, and the usual variation is 3 feet.

Salmon Creek is navigable but a short distance above the inner end of the piers.

The project has had no effect on freight rates.

The commerce of Pultneyville, which is a village of about 300 inhabitants, is insignificant, there being only 6 arrivals and departures, with a tonnage of 160, during the year 1908.

Work proposed for the ensuing year is to make necessary repairs to the piers.

For more extended information and map, see page 2460 et seq., Annual Report of the Chief of Engineers for 1894.

July 1, 1908, balance unexpended	$2,412.16
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	677.31
July 1, 1909, balance unexpended	1,734.85

(See Appendix Q Q 2.)

3. Harbor at Great Sodus Bay, New York.—In its original condition the channel connecting this bay with Lake Ontario was wide and impracticable for vessels drawing over 8 feet.

The original project of 1829 was to narrow the entrance by constructing two converging breakwaters and to secure a channel of 12 feet depth by building two parallel piers about 450 feet apart, connecting with the ends of the breakwater, and by dredging. The present project, of 1882, is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the two piers a total of 1,100 feet and by dredging. After the piers had been extended 519 feet to their present lengths—west pier, 1,580 feet; east pier, 1,294 feet—the project was modified July 18, 1896, to restore and maintain the channel 150 feet wide between the piers, flaring to 250 feet in the lake, to the requisite depth of 15 feet at low water, by dredging, without further extension of the piers for the present.

The piers are 473 feet apart; east breakwater 1,651 feet long, west breakwater 2,200 feet long. During the fiscal year repairs were made to the piers to the extent necessary to prevent serious damage by seas, and at the close of the year the work of tearing out old timber superstructure on the piers and replacing it with concrete was fairly started, the work being done by hired labor.

The funds recommended to be appropriated for the fiscal year ending June 30, 1911, will be used to continue the concrete work, to make the improvement available. The project is completed except maintenance.

The amount expended to June 30, 1909, was $502,586.91, of which $94,335.11 was for maintenance.

The minimum depth June 30, 1909, was 11½ feet at low water in a channel width of 150 feet, and the usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of commerce at this port for the past ten years, in tons: 1899, 78,885; 1900, 84,379; 1901, 84,379; 1902, 26,726; 1903, 18,875; 1904, 30,797; 1905, 46,251; 1906, 58,905; 1907, 78,057; 1908, 73,989.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2441 et seq.

A chart of Great Sodus Bay is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 234.

July 1, 1908, balance unexpended	$48,429.34
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,530.45
July 1, 1909, balance unexpended	44,898.89
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	55,000.00

(See Appendix Q Q 3.)

4. Harbor at Little Sodus Bay, New York.—In its original condition the channel connecting this bay with Lake Ontario was about 150 feet wide and 18 inches deep.

The original project of 1854 was to protect the channel by building two parallel piers 250 feet apart across the bar to the 15-foot curve in the lake and to connect them with the shore by breakwaters. In 1867 this project was modified to provide for dredging to the depth of 12 feet. The present project, of 1882, is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the piers to the 15-foot curve in the lake, and by dredging. The piers had been extended 835 feet to the following lengths—west pier, 1,747 feet; east pier, 1,510 feet—when the project was modified June 29, 1898, to restore and maintain the entrance channel, 150 feet wide, to the requisite depth of 15 feet, by dredging, without further extension of the piers for the present; and this was modified by the river and harbor act of June 13, 1902, to extend the east pier 300 feet.

This extension was built—timber-crib substructure and concrete superstructure—in 1904, making the present length of the east pier 1,810 feet.

The west pier is 1,747 feet long; the east breakwater 1,680 feet long; west breakwater, 469 feet long, but entirely buried in sand and no longer maintained.

During the fiscal year the work of replacing with concrete the timber superstructure on the piers was continued slowly, the work being hampered by high water. Three hundred and twenty-six linear feet was completed. At the close of the year the U. S. dredge *Frontenac* was employed in restoring project depth in the channel between the piers. The project is completed except maintenance.

The appropriation recommended will be applied to continuing the work outlined above to make the improvement available.

The amount expended to June 30, 1909, was $425,740.68, of which $124,377.88 was for maintenance.

The minimum depth over the shoalest part of the locality under improvement, June 30, 1909, was 13 feet at low water in a channel width of 100 feet, and the usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of commerce at this port for ten years, in tons: 1899, 81,969; 1900, 59,511; 1901, 135,118; 1902, 52,543; 1903, 120,692; 1904, 137,258; 1905, 105,298; 1906, 103,991; 1907, 108,804; 1908, 153,474.

Work proposed for the ensuing year, necessary to make the improvement available, consists in maintenance of channels and piers.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2443 et seq.

A chart of Little Sodus Bay is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 227.

July 1, 1908, balance unexpended	$61,055.06
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	17,512.01
July 1, 1909, balance unexpended	43,543.05
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	35,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix Q Q 4.)

5. *Harbor at Oswego, New York.*—This harbor comprises the lower part of Oswego River, a cove at its mouth, protected by a breakwater now known as the inner breakwater, and an outer harbor formed by an outer breakwater. In its original condition the harbor in the Oswego River was navigable by vessels of light draft only, and the cove had no protection against the lake seas.

The original project of 1827 (completed in 1829) was to build across the cove a breakwater of timber cribs filled with stone. Between 1830 and 1838 a superstructure of masonry was built on 500 feet of this breakwater. Between 1866 and 1869, $41,000 was expended in dredging the harbor to the depth of 12 feet at extreme low water. Between 1868 and 1870 a light-house pier was built, extending north 437 feet from the channel end of the breakwater. In 1871 the project for an outer harbor formed by an outer breakwater was adopted, and in 1881 an outer breakwater was completed having a lake face 4,870 feet long, a westerly shore return 916 feet long, and an easterly return 246 feet long. In 1881 a project was adopted to build an east breakwater, 248 feet of which was constructed in 1881 and removed in 1889. In 1885 and 1889 two spurs to the outer breakwater, 100 and 150 feet long, respectively, were built.

In the acts of March 3, 1893, and August 18, 1894, special provisions were made for extending the deep-water area of the harbor in the mouth of the Oswego River by the removal of rock.

The present project was adopted June 3, 1896, based on a special report printed in the Annual Report of the Chief of Engineers for 1895, page 3213, et seq, and as subsequently modified is, first, to build an east breakwater 1,435 feet long, at an estimated cost of $197,000 (acts of March 3, 1895, and June 3, 1896); second, to narrow the breach made in the outer breakwater in 1884 from 175 feet to about 75 feet, at an estimated cost of $18,500; third, to widen and deepen the inner harbor in the mouth of the Oswego River and to extend the deep-water area farther upstream by rock excavation.

There are 5,907 feet of outer breakwater and 1,993 feet of inner breakwater and light-house pier, forming an outer harbor containing 140 acres and an inner harbor containing 9.35 acres (including the Oswego River). The areas having a controlling depth of 14.5 feet at low water are 40 acres in the outer harbor and 4½ acres in the inner harbor.

Under maintenance there is required: The maintenance of the outer breakwater and inner breakwater and light-house pier, the maintenance of a depth of 15.7 feet at low water in the entrance channel and in the outer harbor, and the maintenance of a depth of 15 feet at low water in the cove behind the inner breakwater and in the harbor in the mouth of Oswego River.

The plane of reference is low water (zero of Oswego gauge).

The outer breakwater is difficult and costly to maintain.

The river and harbor act of March 3, 1905, made an appropriation for continuing repairs with timber under the method printed as plan "B" on page 3368, Annual Report of the Chief of Engineers for 1904. Under this appropriation extensive repairs were made with timber to the outer breakwater during 1905-6, and owing to extensive damage by storms were continued during the past fiscal year to preserve parts damaged from complete destruction.

The river and harbor act of March 2, 1907, made an appropriation of $100,000 and authorized contracts to the extent of $100,000 additional, all of which has been appropriated, for reconstruction under plan "A," printed on page 3368 of the Annual Report of the Chief of Engineers for 1904, which contemplates a stone superstructure and sea slope, at an estimated cost of $900,000. This work was begun during the fiscal year 1908.

The amount expended for all work to June 30, 1909, was $2,211,564.70. It is impracticable to separate the cost of construction and maintenance. The project is completed except for maintenance, which is being prosecuted under a plan specifically adopted by Congress.

The funds recommended to be appropriated for the fiscal year ending June 30, 1911, will be used to continue the reconstruction of the outer breakwater, to make the improvement available.

June 30, 1909, the minimum depth at low water over the shoalest part of the locality under improvement was 14 feet.

The usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of the commerce of this harbor for the past ten years, in tons: 1899, 716,753; 1900, 575,160; 1901, 565,052; 1902, 334,009; 1903, 733,734; 1904, 712,481; 1905, 724,502; 1906, 615,840; 1907, 728,090; 1908, 724,187.

Work proposed for the ensuing fiscal year, necessary to make the improvement available and extend its benefits, consists in dredging on shoals as may be required in the outer harbor and entrance channel, continuing the reconstruction of the outer breakwater under plan "A," and repairs on timber structures when required. The appropriation recommended will be applied to this work.

Report of survey of the outer breakwater is printed on page 3363 et seq. of the Annual Report of the Chief of Engineers for 1904.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2451 et seq.

A chart of Oswego Harbor is published in the series of charts of the survey of the Northern and Northwestern Lakes, index 225, and an index map facing page 2160 of the Annual Report of the Chief of Engineers for 1903.

July 1, 1908, balance unexpended	$82,109.89
Amount appropriated by sundry civil act approved March 4, 1909	100,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909	40,000.00
Sales	11.00
	222,120.89
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	66,777.94
July 1, 1909, balance unexpended	155,342.95
July 1, 1909, amount covered by uncompleted contracts	38,534.51
Amount (estimated) required for completion of existing project	700,000.00

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	$200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Q Q 5.

6. *Harbor at Cape Vincent, New York.*—This harbor in its original condition was an open roadstead on the St. Lawrence River, 2½ miles from Lake Ontario, and is a convenient location for vessels to lie during storms, at night, and in thick weather.

The original project of 1896 was to build a breakwater, 1,600 feet long, parallel to and 600 feet from the railroad wharf, at an estimated cost of $320,000. On May 13, 1899, this project was modified to build a breakwater parallel to and 500 feet from the railroad wharf, 1,550 feet long, of which length 150 feet, or so much thereof as required, was to be a shore return at upper end, at an estimated cost of $200,000. Nine hundred and ten feet of this breakwater, of which 50 feet is shore return, has been built. Further extension of the shore return is not considered necessary. The project is about three-fifths completed. No work was done during the fiscal year. There was $128.62 expended for pay of watchman and for traveling expenses.

The amount expended to June 30, 1909, was 127,279.79, of which $270.39 was for maintenance.

The maximum draft that could be carried over the locality under improvement at low water June 30, 1909, was 19 feet, and the usual variation of level of water surface is 3 feet.

The commerce of Cape Vincent is not large. This improvement is intended to make a harbor of refuge for all craft plying between Lake Ontario and the St. Lawrence River.

The following is a statement of the commerce of this port, in tons, for the years given: 1901, 4,209; 1902, 4,175; 1903, 15,666; 1904, 20,083; 1905, 21,750; 1906, 112,501; 1907, 21,946; 1908, 33.573.

Work proposed for the next fiscal year is the continuation of the breakwater, and the amount asked for will be applied to this work for the purpose of extension of benefits.

For more extended information and map, see Annual Reports of the Chief of Engineers for 1897, page 3286, et seq., and for 1903, page 2162, et seq.

The project has provided facilities that make navigation more safe and thus affects freight rates.

July 1, 1908, balance unexpended	$848.83
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	128.62
July 1, 1909, balance unexpended	720.21
Amount (estimated) required for completion of existing project	72,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	72,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Q Q 6.)

7. *Harbor at Ogdensburg, New York.*—In its original condition the low-water depth in this harbor was 9 feet in the upper entrance channel leading to the Oswegatchie River, 10 to 12 feet in the two lower entrance channels, and 6 to 12 feet along the city front.

The original project of 1868 was to dredge the channels to the depth of 12 feet and to build, if necessary, 5,500 linear feet piers, at an estimated cost of $100,000. The piers were never built. The project of 1882 provided for dredging the upper entrance channel from the St. Lawrence River channel across the shoal to and into the mouth of the Oswegatchie to 16 feet, and the lower entrance channels and channels along the city front to 15 feet at extreme low water, at an estimated cost of $75,000. The present project (see Annual Report of the Chief of Engineers for 1890, p. 2872) provided for dredging all the channels to a depth of 16.5 feet below the zero of the Ogdensburg gauge (15 feet below the zero of the Oswego gauge), at an estimated cost of $158,950. The project was modified February 27, 1897, to deepen the two lower entrance channels to 16 feet below the zero of the Oswego gauge, and by act of March 3, 1899, further modified to dredge 900 feet of the channel along the front of Ogdensburg above Franklin street to but 14 feet below the same zero, the projected depths of the upper entrance channel to and into the mouth of the Oswegatchie River up to the bridge, and the balance of the channel along the city front to remain 15 feet. The dredging of all of the channels of the project was completed in July, 1903, but they are not stable, and frequent redredging is necessary to maintain the required depths.

The project is completed except maintenance.

Work of redredging to restore project depths was nearly completed at the close of the fiscal year, and as it will be completed with funds on hand, no estimate is made for the next fiscal year.

The amount expended to June 30, 1908, was $389,660.64, of which $118,296.99 was applied to maintenance of improvement.

The maximum draft that could be carried over the improvement at low water (zero of new Ogdensburg gauge corresponding to zero of Oswego gauge), June 30, 1909, was as follows: In the lower entrance channels, 16 feet; in the upper entrance channel, 15 feet; in the channel along the city front above Franklin street, 14 feet; below Franklin street, 15 feet. The usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of commerce at this port for the past ten years, in tons: 1899, 670,363; 1900, 646,248; 1901, 646,248; 1902, 837,025; 1903, 1,185,785; 1904, 898,257; 1905, 1,034,085; 1906, 1,056,100; 1907, 1,238,498; 1908, 856,714.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2451, et seq. Reference to reports on examination and survey made in compliance with act of March 2, 1907, will be found on page 779 of Report for 1908.

July 1, 1908, balance unexpended	$55,652.22
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	28,374.57
July 1, 1909, balance unexpended	27,277.65
July 1, 1909, amount covered by uncompleted contracts	7,205.53

(See Appendix Q Q 7.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE LOS ANGELES, CALIFORNIA, DISTRICT.

This district was in the charge of Capt. Amos A. Fries, Corps of Engineers, having under his immediate orders the following officers of the Corps of Engineers: First Lieut. C. T. Leeds during the entire year, and First Lieut. A. R. Ehrnbeck from January 7 to May 13, 1909. Division engineer, Lieut. Col. John Biddle, Corps of Engineers.

1. San Diego Harbor, California.—San Diego Harbor is just north of the national boundary of Mexico and 482 nautical miles south of San Francisco.

The river and harbor act approved March 3, 1875, appropriated $80,000 for the construction of a dike across the mouth of San Diego River, causing it to empty into False Bay, and thus preventing San Diego Harbor from being injured by the deposit of material brought down during flood stages. This work was completed in 1876 at a cost of $79,798.72, which, with the cost of repairs made up to the time of adoption of the present project, brought the total expenditures to $81,918.45. Further repairs to the dike have been made by the city of San Diego.

The project for the improvement of the harbor, adopted by the river and harbor act approved September 19, 1890, provided for the construction of a jetty on Zuninga shoal, at the entrance to the harbor; the maintenance of a channel 24 feet deep at mean low tide and 500 feet wide through the "middle ground," and for repairs to restraining dike. The jetty was to rise to the height of extreme high water and to be about 7,500 feet long, with a view to producing a depth of 26 feet at mean lower low water on the outer bar.

At the time of the adoption of this project the governing depth on the bar was 21 feet. Just inside the entrance was a middle ground carrying but 17 feet of water. The main channel, lying to the west of the middle ground, was of ample depth, but was difficult of navigation on account of two sharp turns.

The original estimated cost of this improvement was $394,400. This estimate was increased in June, 1900, to $542,850. With this amount the jetty was extended to its full contemplated length of 7,500 feet, a channel 26 feet deep and 271 feet wide (28 feet deep over a width of 171 feet) was dredged across the outer bar, and a channel 26 feet deep and 400 feet wide was dredged across the middle ground. Later the channels through the outer bar and the middle ground both shoaled to 24 feet deep. The amount expended on this harbor up to the completion of this project was $625,214.94.

The work done since the completion of the above project has been the maintenance of the channel through the outer bar. Under contracts, 15,625 cubic yards at 60 cents per yard and 37,750 cubic yards at 51 cents per yard was dredged and dumped at sea. A channel 225 feet wide and 28 feet deep over the east 100 feet and 27 feet deep over the west 150 feet has been dredged. This channel has since shoaled to 25 feet depth, which is the maximum draft that could be carried into the harbor at mean lower low water to June 30, 1909. The average height of all high waters above the plane of reference is 4.8 feet. The average of the higher high tides is 5.5 feet.

From the appropriation of $8,185,750, made by river and harbor act of March 3, 1909, $30,000 has been allotted for maintaining the channel through the outer bar. A contract will be entered into at an early date for dredging 100,904 cubic yards of material at $0.2874 per yard. A channel 200 feet wide and 28 feet deep at mean lower low water will be excavated.

The amount expended on this project (maintenance) to June 30, 1909, is $29,866.99. Any additional appropriations for maintenance will be expended in dredging the channels through the outer bar and the middle ground.

The commerce of this harbor was 250,866 tons for the calendar year 1908, a decrease of 3 per cent from that of the previous year. It consists principally of lumber, general merchandise, and ore shipped. The value of this commerce is estimated to be $11,191,460.

The coastwise trade is carried in vessels drawing from 12 to 20 feet of water, and is benefited but little by the improvement of the harbor. The American-Hawaiian steamers, of 8,000 to 10,000 tonnage each, enter this port once a month. These vessels draw about 26 feet of water and carry 1,000 to 2,000 tons of freight per month for San Diego. Freight for San Diego carried by the Panama steamers is delivered by coastwise steamers from San Francisco. The American-Hawaiian steamers and the Panama steamers have a rate from the Atlantic ports to San Diego averaging about 30 per cent cheaper than railroad rates. Foreign cements are received in this port in sailing vessels drawing 22 and 23 feet of water.

For references to reports on examinations and surveys, see Annual Report of Chief of Engineers for the year 1904, page 632, and page 785 of report for 1908.

July 1, 1908, balance unexpended	$306.18
Amount allotted from appropriation by river and harbor act approved March 3, 1909	30,000.00
	30,306.18
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	34.85
July 1, 1909, balance unexpended	30,271.33
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	30,000.00

(See Appendix R R 1.)

2. *Deep water harbor at San Pedro Bay, California.*—The river and harbor act of June 3, 1896, provided for the appointment of a Board to determine upon the location of a deep-water harbor for commerce and of refuge in Santa Monica Bay, California, or at San

Pedro, in the same State, the decision of a majority of the Board as to location to be final. The Board was to make plans, specifications, and estimates for said improvement. After the Board should have rendered its decision and submitted its report the Secretary of War was empowered to make contracts for the completion of the selected harbor in accordance with the project of the Board, at a cost not exceeding in the aggregate $2,900,000.

In accordance with the provisions of this act a Board was appointed, which submitted its report March 1, 1897, deciding in favor of San Pedro Bay. The report of the Board is printed in Senate Document No. 18, Fifty-fifth Congress, first session.

The plan of the Board (the present project of improvement) was to construct, to the eastward of Point Fermin, a breakwater about 8,500 feet long, or as much longer as could be constructed within the authorized limit of cost, $2,900,000, and it has been decided that a breakwater 9,250 feet long should be built. In plan the breakwater is to consist of two straight arms connected by a curve 1,800 feet in length, of 1,910 feet radius. The westerly arm is to be 3,000 feet long, pointing S. 72° E. (magnetic); the easterly arm, as extended, 4,450 feet long, pointing N. 54° E. (magnetic). A gap of about 1,850 feet is to be left between the east shore of Point Fermin and the westerly end of the breakwater.

Originally San Pedro Bay was an open roadstead exposed to southeasterly, southerly, and southwesterly winds. The effect of the breakwater will be to afford a place of refuge, easy of access and secure from storms, for vessels of the largest size. It will also shelter the entrance to the inner harbor of San Pedro.

On August 12, 1898, a continuing contract was entered into with Heldmaier & Neu, of Chicago, Ill., for the construction of the breakwater, for $1,303,198.54. This contract was annulled on March 19, 1900, on account of unsatisfactory progress. Under this contract 86,610 tons of stone was placed in the foundation course, at a cost, including inspection, of $51,537.43.

On June 7, 1900, a continuing contract for completing the breakwater was entered into with the California Construction Company, of San Francisco, Cal. The estimated cost of work under this contract, using the quantities on which bids were convassed and the prices bid for stone and concrete, and allowing 10 per cent for engineering expenses and contingencies, is $2,613,100.66, in addition to expenditures under the former contract. This estimate is for a breakwater 8,500 feet long. The extension of the breakwater to 9,250 feet in length is estimated to cost about $272,500 additional.

The amount expended under the project up to the close of the fiscal year ending June 30, 1909, is $2,726,697.46.

Work was begun on the westerly end of the substructure. Up to June 30, 1909, 2,204,909 long tons of stone, at $0.844 per ton, had been deposited in the substructure under the present contract, and the substructure was about completed for a distance of 9,174 feet. Some stone has been dumped 128 feet farther, which is approximately at the toe of the end slope of the completed breakwater.

The superstructure was begun in October, 1902. To June 30, 1909, 222,038 long tons of stone had been placed in the superstructure, at $3.10 per ton, and this, while partially completing it over a length of 8,884 feet, is equivalent to 8,458 feet of completed work.

The protected area is used by vessels which have to lighter a part of their cargo or have to await a favorable tide before they can enter the inner harbor. The effect of continuing work under the existing project will be to improve the protection of the sheltered area and the entrance to the inner harbor.

The authorized cost of the project, $2,900,000, has been appropriated. The project is about 97 per cent completed. The available balance will be expended in building up the breakwater to its full project height under the contract.

There are as yet no commercial wharves in the outer, or breakwater, harbor. The construction of bulkheads, etc., has been begun, but little progress has been made owing to the financial stringency. It is expected, however, that facilities for commerce will be greatly developed during the coming year. For commercial statistics see report on Wilmington Harbor.

For references to reports on examinations and surveys see Annual Report of the Chief of Engineers for the year 1904, page 634, and page 785 of report for 1908.

July 1, 1908, balance unexpended	$285,871.90
Amount appropriated by sundry civil act approved March 4, 1909	100,000.00
	385,871.90
June 30, 1909, amount expended during fiscal year, for works of improvement	212,569.31
July 1, 1909, balance unexpended	173,302.59
July 1, 1909, outstanding liabilities	27,414.38
July 1, 1909, balance available	145,888.21
July 1, 1909, amount covered by uncompleted contracts	94,015.18

(See Appendix R R 2.)

3. *Wilmington Harbor, California.*—Wilmington is situated at the head of a small estuary which has its outlet in the Bay of San Pedro, and is 393 nautical miles to the southward of San Francisco.

Previous to the commencement of the improvement, in 1871, there was a depth of less than 2 feet of water at low tide at the entrance.

The original project, approved July 1, 1871, contemplated gaining a depth of 10 feet at mean low tide. This depth was obtained in 1881, at a cost of $555,000, when a further project to increase depth of channel to 15 feet at mean low tide by dredging a reef between the jetties, raising existing works, and extending the jetties to 18 feet of water in San Pedro Bay was submitted. This project was completed in 1893, at a cost of $399,497.68.

The river and harbor act of June 3, 1896, appropriated $50,000 for improving the harbor in accordance with a project submitted in 1894 for a channel depth of 18 feet at mean low tide, at an estimated cost of $392,725. Owing to certain provisos, however, this money was not available without further action by Congress.

The present project was adopted by the river and harbor act of June 13, 1902, and contemplates providing a channel 20 feet deep and 400 feet wide from the outer harbor to the foot of the wharves, and 24 feet deep between harbor lines from the foot of the wharves to and including a turning basin 1,600 feet in diameter just below Mormon Island. It also provides for repairs to the east jetty and for the construction of a dike to divert the waters of the Los Angeles River from Wilmington Lagoon. The same act made available the $50,000 appropriated by the act of June 3, 1896.

Changed conditions have rendered the building of the dike inadvisable.

The original estimated cost of the work called for by the present project, including the procurement of a dredge, is $550,000. This estimate has been increased to $663,000. The full amount of the estimated cost has been appropriated.

The amount expended under the existing project to June 30, 1909, is $611,194.32, and the project is about 92 per cent completed.

Repairs have been made to the east jetty at a cost of $3,700.

A 20-inch suction dredge, with the necessary discharge pipe, floating plant, etc., has been built at a total cost of $118,721.78. The work of dredging the harbor began April 1, 1905, since which time 3,437,063 cubic yards of material has been dredged and deposited behind bulkhead lines on Terminal and Smiths islands, or outside the jetties, at a cost, including deterioration of plant, of $288,066.86, or about $0.0838 per cubic yard. At the entrance to the harbor 355,785 cubic yards has been dredged under contract at a cost of $168,579.90 (contract payments only), and between the entrance and the upper end of the wharves 249,340 cubic yards has been dredged under contract at a cost of $39,894.40.

The entrance channel has been dredged to a width of 400 feet and a depth of 21 feet. A channel 400 feet wide, with a least depth of 20 feet, has been dredged from the entrance to the lower end of the wharves, and dredging to a depth of 25 feet has been done between the wharves as far north as the turning basin just above Smiths Island, a distance of about 5,000 feet. This depth of 25 feet, with a width of 400 feet, has also been carried along the easterly and westerly sides of the turning basin, and a cut 200 feet wide and 25 feet deep to connect these side channels is being excavated around its northern periphery.

From the appropriation of $8,185,750 made by river and harbor act of March 3, 1909, $20,000 has been allotted for operating government plant toward completing the present project, removing any shoalings that may be found to have occurred, and in caring for and making repairs to the plant while being laid up awaiting further action by Congress.

For the calendar year 1908 the commerce of this port amounted to 1,005,697 tons, a decrease of 10 per cent from the preceding year. It consists principally of lumber, crude oil, and general merchandise received, and of general merchandise and crude oil shipped. Its value is estimated at $25,189,300.

It is difficult to estimate accurately the effect of this improvement on freight rates. The principal traffic of the harbor is in lumber received from northern California, Oregon, and Washington, and shipped inland by rail, and amounts for the calendar year 1908 to nearly 1,000,000 tons. The water rate on lumber from Puget Sound points to Los Angeles is about $5 per ton; the railroad rate, $12.50 per ton. Without the improvement of Wilmington Harbor, lumber would have to be unloaded at exposed piers or brought to San Pedro in vessels of light draft or lightered ashore. The saving in freight, lighterage charges, and insurance is large, but can not be definitely stated.

For reference to reports on examinations and surveys, see Annual Report of the Chief of Engineers for the year 1904, page 635, and House Document No. 1114, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$117,031.92
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
Receipts from sales	35.25
	137,067.17
June 30, 1909, amount expended during fiscal year, for works of improvement	64,626.67
July 1, 1909, balance unexpended	72,440.50
July 1, 1909, outstanding liabilities	1,753.72
July 1, 1909, balance available	70,686.78
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	45,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R R 3.)

4. San Luis Obispo Harbor, California.—San Luis Obispo Harbor is 9 miles to the southward and westward of the town of San Luis Obispo and 216 nautical miles from San Francisco.

It is a bight of the coast about 18 miles long between Point San Luis on the north and Point Sal on the south. Port San Luis (formerly Port Harford) is situated at its upper end, where a commercial wharf has been maintained for many years. In 1907 commercial wharves were also built at Avila and at Oilport, just easterly of Avila. The latter wharf, however, was destroyed shortly after it was built.

Whaler reef, extending nearly half a mile to the southward and eastward of Point San Luis, forms more or less of a natural breakwater, but during the winter season the landing was exposed to the heavy swell caused by southerly gales.

The original project was adopted by the river and harbor act of August 11, 1888, and provided for the construction on Whaler reef of a breakwater of rubblestone rising to mean lower low water and extending from Point San Luis to Whaler Island and thence to a point where the outer reef rises above high water. Exclusive of Whaler Island, which is 245 feet long, the breakwater was to have a length of about 1,736 feet, and its estimated cost was $284,898.

This project was modified January 17, 1893, to provide for raising the structure to the height of 6 feet above mean high water, with a top width of 20 feet and such side slopes as might be formed under the action of the sea. The estimated cost was increased to $568,660. This is the existing project.

The amount expended on this work up to June 30, 1909, is $321,461.36, and the project is 57 per cent completed.

There has been placed in the breakwater 146,515 short tons of stone.

The breakwater has been built to full section from Point San Luis to Whaler Island and for 765 feet beyond Whaler Island, and has been partly built up for 795 feet farther, or a total distance of 2,141 feet, including the island. The partially protected area has an available depth of 20 to 33 feet at mean lower low water and there is 30 feet depth at the Port San Luis wharf. The mean rise of tide is 4.6 feet. The result has been to give increased security to vessels in the anchorage and at the landing.

The river and harbor act of March 2, 1907, appropriated $63,660 and authorized continuing contracts for the completion of the work at a cost not to exceed the additional amount of $200,000, of which $110,000 remains to be appropriated.

A continuing contract for completing the breakwater has been entered into which provides for the delivery of 151,140 tons of stone at $1.57 per ton, the amount necessary to complete the project. Work was to have been begun May 1, 1908, but on account of the shoaling of the channels at the quarry at Morro rock and the heavy seas, no stone was delivered until August, 1908, and only 9,205 tons until December, when work was suspended during the winter. The shoaling has since increased so that it is now impossible to get a barge near enough to the quarry to load it. As this is the only available quarry authority has been given the contractor to suspend work during this working season, or until the channels should deepen sufficiently to permit of the work being resumed.

Further work under the project will afford increased shelter. The unexpended balance and the $110,000 yet to be appropriated should be applied to the extension of the breakwater to its full projected length and height.

The commerce consists principally of lumber and general merchandise received and grain and crude oil shipped. Its volume for 1908 is 1,071,469 tons, a decrease of 2 per cent from that of the previous year. The value of this commerce is estimated at $7,698,024.

It is impracticable to give definite figures relative to the influence of the project on freight rates. The following, however, may throw some light on the matter. The Union Oil Company pumps crude oil through a 6-inch pipe from its well in the northern part of Santa Barbara County, a distance of 40 to 45 miles, to the landing at Port San Luis, and thence ships it in tank vessels to the Hawaiian Islands and coast points. The Standard Oil Company also ships oil from this port. The cost of delivery of oil in San Francisco is about 10 cents per barrel, and the oil is sold there for from $0.90 to $1 per barrel. The railway rate to San Francisco is about 60 cents per barrel.

Reference to reports on examinations and surveys will be found in Annual Report of the Chief of Engineers for the year 1904, page 636.

July 1, 1908, balance unexpended	$122,826.10
Amount appropriated by sundry civil act approved March 4, 1909	30,000.00
	152,826.10
June 30, 1909, amount expended during fiscal year, for works of improvement	15,626.51
July 1, 1909, balance unexpended	137,199.59
July 1, 1909, amount covered by uncompleted contracts	224,287.34
Amount (estimated) required for completion of existing project	110,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	100,000.00

(See Appendix R R 4.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated April 24, 1907, and December 17, 1907, on preliminary examination and survey, respectively, of *Wilmington Harbor, California*, with a view to obtaining increased depth, required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1114, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $420,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST SAN FRANCISCO, CALIFORNIA, DISTRICT.

This district was in the charge of Lieut. Col. John Biddle, Corps of Engineers, division engineer, Pacific division.

1. Oakland Harbor, California.—The original condition of San Antonio estuary was as follows: It was a tidal arm of the Bay of San Francisco, with a tidal prism of 156,000,000 cubic feet. This filled and emptied itself with each coming tide. The tidal flow was sufficient to maintain a natural channel depth over the bar, off the mouth, of 2 feet at low tide. Within the estuary proper, where the bends are pronounced, mid-channel depths of 20 to 23 feet at low water and widths of 500 feet were found. Vessels drawing 5 to 8 feet could enter at high tide. The commerce in 1874 aggregated 154,300 tons.

The original project was submitted in 1874 in compliance with an act of Congress. The report, with project and estimate of cost, is printed in the Annual Report of the Chief of Engineers for 1874, page 378. This project called for (*a*) two mid-tide training walls at the entrance, (*b*) a tidal canal for flushing purposes about 1½ miles in length to connect with tide water in San Leandro Bay, (*c*) a dam at the entrance to San Leandro Bay, and (*d*) dredging a tidal basin and then a channel to have a depth of 20 feet from the basin to San Francisco Bay. The estimated cost of the work was in round numbers $1,815,000.

This was approved by Congress, and during the progress of the work slight modifications were made from time to time. These consisted of raising the training walls to full high-tide level; of increasing the width of the tidal canal to 400 feet; of building three steel bridges across the tidal canal; and of diverting the silt-laden storm waters of Sausal Creek from the tidal canal by means of a separate channel into San Leandro Bay.

The present project was adopted before this project was completed. Up to and including 1900, $2,450,600 had been expended on the original project.

In the river and harbor act of 1900 Congress provided for an examination of Oakland Harbor with a view to its improvement west of the tidal canal to meet the needs of present and prospective commerce. Three alternative plans and estimates for channel enlargement were submitted, estimated to cost, respectively, $646,293, $1,687,818, and $968,203. This report, with estimates, is printed in the Annual Report of the Chief of Engineers for 1901, pages 3448–3449.

On June 13, 1902, Congress appropriated $100,000 and authorized continuing contracts for $150,000 additional for the work, but failed to specify to which of the above projects the funds were to be applied. Contract was made to the extent of the money available and authorized for dredging work which was common to all of the above projects. By act of March 3, 1905, Congress specifically named project No. 3, estimated to cost $968,203, appropriated $100,000, and authorized contracts for $250,000 additional for continuing the improvement with a view to obtaining a channel 300 feet wide and 25 feet deep from San Francisco Bay to Fallon street, Oakland.

Project No. 3 calls for a channel from San Francisco Bay, 500 feet wide and 25 feet deep at low water, to Chestnut street, Oakland; thence 300 feet wide and 25 feet deep at low water to Fallon street; thence 300 feet wide and 17 feet deep to tidal basin; thence 300 feet wide and 12 feet deep around the tidal basin, and extension of south jetty.

In the act of March 2, 1907, Congress provided for the project No. 3, as recommended by the Board of Engineers for Rivers and Harbors in report of January 11, 1907, printed in River and Harbor Committee Document No. 9, Fifty-ninth Congress, second session, but the act extended the provisions of the project as follows:

Extension of south jetty 500 feet, widening to 500 feet the channel 25 feet deep from San Francisco Bay to Fallon street, deepening to 25 feet the channel 300 feet wide from Fallon street to the tidal basin, deepening to 17 feet the channel 300 feet wide around the north side of the tidal basin to the tidal canal, and from the tidal canal along the Alameda shore to Tenth avenue. The two preceding paragraphs cover the final project. The estimate of cost is $1,468,203.

The work is in progress under the continuing-contract system. The full appropriation under contract authorization has been made. In order to complete the improvement directed by Congress, an additional amount of $500,000 is estimated.

On June 30, 1909, at mean lower low-tide level, a channel 300 feet wide and 25 feet deep has been made for a length of 25,000 feet easterly from deep water in San Francisco Bay to the tidal basin at Tenth avenue. From the bay to Chestnut street this channel has a width of 400 feet with a depth of 20 feet in the additional 100 feet width, and from Chestnut to Castro streets and from Harrison to Fallon streets the channel has a width of 400 feet with 25 feet depth. In the tidal basin there is a partly completed channel 300 feet wide, 17 feet deep on the north side from Tenth avenue to Fifteenth avenue, a distance of 3,200 feet, the balance to the canal being 300 feet wide and 6 feet deep. On the Alameda side there is a partly completed channel 300 feet wide, 17 feet deep from Tenth avenue to Willow street, a distance of 5,300 feet, and the balance to the canal 300 feet wide and 6 feet deep. The range of the tides is 4.5 to 5.5 feet. The navigable portion of the channel is about 32,000 feet in length. Light-draft vessels can go a half mile farther east. The amount spent on the existing project is $702,006.86. The project is about half completed.

The money thus far spent has been practically all for extensions in channel widths and depths for the benefit of commerce. There has been spent for the maintenance of bridges since the adoption of present project $4,747.79. The sum of $5 has been received during the year from the sale of an old typewriter. High Street Bridge was destroyed by fire on May 21, 1909. Repairs will be undertaken early in the coming year.

It is difficult to estimate what increase of commerce is likely to result from an increased depth and width of channel in Oakland Harbor. At present about 64 per cent of the total tonnage of Oakland Harbor is overland freight transferred across the bay on ferryboats, which, when loaded with cars, draw only about 8 feet of water. If improvement be continued it will permit the deeper draft vessels carrying to the city of Oakland coal, wood, coke, oil, hay, grain, flour, lumber, building material, and sundries, which in 1908 amounted to 3,601,871 tons, valued at $142,808,120, and also should induce a large increase in manufacturing industries on the shores of this harbor.

It is believed that the improvement has had no material effect on freight rates. Passenger rates are 5 cents per trip, while all other ferries charge 10 cents per trip.

It is proposed to spend the funds available for dredging in accordance with contract for extension of benefits.

It is proposed to spend the funds estimated in continuing work in accordance with project directed by Congress. This will be for the extension of benefits. The amount asked for as maintenance it is proposed to use for repairs of bridges and for dredging small shoals that may develop, particularly at the mouth of the channel. The original project did not provide for maintenance. It has developed that the bridges have to be maintained and that shoals develop and must be dredged. This is in part due to the fact that while the tidal prism remains the same as in the project of 1874, the size of the channel is largely increased in the present project.

In connection with this improvement a tidal canal connecting San Leandro Bay with Oakland Channel was excavated by the United States. This canal was intended for flushing purposes only and no provision was made for operation of bridges over it which are owned by the United States and are provided with draws. A demand appears to have arisen for the opening of the canal to navigation, as explained in the district officer's report, but the bridges form an impediment to such use, and he recommends that they be turned over to the local authorities, who have signified their willingness to accept and operate them.

July 1, 1908, balance unexpended		$284, 454. 37
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15, 000. 00
Amount appropriated by sundry civil act approved March 4, 1909		256, 000. 00
Amount received by reimbursement from Isthmian Canal Commission		14. 21
Amount received from sale of old typewriter		5. 00
		555, 473. 58
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$273, 472. 73	
For maintenance of improvement	785. 50	
		274, 258. 23
July 1, 1909, balance unexpended		281, 215. 35
July 1, 1909, outstanding liabilities		28, 416. 27
July 1, 1909, balance available		252, 799. 08

July 1, 1909, amount covered by uncompleted contracts	$187,548.10
Amount (estimated) required for completion of existing project	500,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	315,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S S 1.)

2. *San Pablo Bay, California.*—Before work was commenced there was a shoal about 27,000 feet long, with a least depth of 19 feet at low water, with a gradual increase of depth toward each end of the shoal, where the depth was 30 feet. These depths extended from 1,000 to 1,500 feet in width, and outside of these widths there is a gradual shoaling to each side of the bay. Ships going to and from Port Costa warehouses, from which most of the grain raised in California is shipped, and ships going to and from Mare Island Navy-Yard, all passed over this shoal. In many cases it was necessary to choose the time of high water to pass over the shoal with ships not fully laden. All the commerce passing into and from the Sacramento and San Joaquin rivers passes over this shoal. No project was adopted or improvement made prior to the present project.

Report on examination, with estimate, is printed in the Annual Report of the Chief of Engineers for 1900, page 4260. The project contemplates a channel 300 feet bottom width, 30 feet depth at low water, and 27,000 feet long; estimated to cost $381,000, and about $16,000 per year thereafter for maintenance. Congress adopted this project on June 13, 1902.

This work was completed February 6, 1906. A survey made in April and May, 1907, showed that the channel had shoaled over four-fifths of its length, this shoaling extending for one-half mile, so as to give a depth of only 24 feet, and amounting to 1,000,000 cubic yards.

A survey made in November, 1908, showed a fill above the 30-foot plane since the dredging was completed of about 1,292,000 cubic yards, or over five-eighths of total that was dredged from the channel.

The maximum available depth June 30, 1909, at low tide is about 23 feet. The ordinary range of tide is from 3.5 feet to 6 feet.

The amount expended on this project to June 30, 1909, is $332,804.52.

On June 8, 1908, a joint army and navy board appointed to consider the approach from San Francisco Bay to Mare Island Navy-Yard submitted to the Secretary of War a project for a channel through San Pablo Bay 30 feet deep and 500 feet wide. The estimate was made in connection with the improvement of Mare Island Strait and can not be separated.

Improvement is needed to permit naval vessels to reach Mare Island Navy-Yard at all stages of the tide. It is not required by the present commerce, and has had no effect on freight rates.

The funds on hand will be used to make examinations and to dredge any small shoal places that may develop.

July 1, 1908, balance unexpended	$21,079.47
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	715.58
July 1, 1909, balance unexpended	20,363.89

(See Appendix S S 2.)

3. *San Joaquin River, California.*—Before improvement the channel below Stockton was crooked and difficult to navigate, with a depth of 6 feet and less at low tide. Above Stockton it was navigable only at high water for a few months of the year and carried but little commerce.

The first examination and survey was made in 1875. (See Report of the Chief of Engineers for 1875, p. 729.) In 1877 (see Report of the Chief of Engineers for 1878, p. 1302) a plan of improvement was submitted to dredge shoal parts to 6 feet and to cut off sharp bends. This project was modified from time to time. The present project is generally to secure and maintain by dredging and by cut-offs a channel 9 feet deep and 100 feet wide to Stockton, and one 4 feet deep and 80 feet wide in Mormon Slough up to Miller's warehouse, as well as a temporary improvement of the upper river by snagging, dredging of bars, and partial closing of side channels. No definite estimate has been made for this project. The work done has been practically the use of such funds as were available to improve the worst stretches in the river as they developed year by year. Eight cut-offs have been made below Stockton by the United States and several by the State of California. The dredged depths and cut-offs have maintained themselves fairly well in the main river, but it has been impracticable, on account of the large amount of débris brought down by Mormon Slough, to maintain without continuous dredging navigable depths in Stockton channel, which is about 1½ miles in length and on which the city of Stockton is situated.

The total amount expended on the project up to June 30, 1909, was $553,142.34.

Navigation was kept open to Stockton the entire year. This would, however, not have been possible had not the city of Stockton, under permit of the War Department, constructed a dam near the mouth of Mormon Slough, which intercepts temporarily the flow of the slough, discharging it into the San Joaquin River above the mouth of Stockton channel, after passing over a wide tract of land on which most of the material carried is deposited.

This unfavorable condition at Stockton channel will be largely remedied by an intercepting canal, which is now under construction.

The maximum depth that could be carried to Stockton at mean low tide on June 30, 1909, was about 6 feet. The extreme tidal range is about 3 feet; the freshet range about 12 feet. The distance from Stockton to the mouth of the San Joaquin River is about 45 miles. At high water boats go occasionally to Hills Ferry, 150 river miles above Stockton.

The commerce of the San Joaquin River is reported by the two large steamship companies and individual vessel owners as reaching 509,233 tons during the year 1908, valued at $21,716,334, exclusive of the freight carried by the steam and gasoline launches plying between Stockton and the many river islands which are under cultivation, and which carry large amounts of supplies and produce, but of which no accurate account can be obtained. Nearly all of this freight is carried on the lower San Joaquin River below Stockton, the commerce of the upper San Joaquin being small.

The nature of the commerce has not been changed by these improvements. The improvements have undoubtedly had effect on freight rates, though the amount can not be ascertained.

Funds appropriated will be used in dredging and snagging for the extension of benefits.

On March 7, 1908, in accordance with act of Congress of March 2, 1907, a survey was ordered of this river and its tributary, Stockton channel, from San Francisco Bay to Stockton, Cal., with a view to a 9, 12, and 15 foot navigation. The recommendation of the Board of Engineers for Rivers and Harbors as concurred in by the Chief of Engineers is for a channel 9 feet deep at low water and 200 feet wide, with provision for two cut-offs and the purchase of certain lands, so that if commerce develops a channel 15 feet deep and 300 feet wide may be provided. The estimated cost is $240,000, and $25,000 a year for maintenance. (See House Document No. 1124, Sixtieth Congress, second session.)

The amount estimated as required for the fiscal year 1911 will be used for maintenance of improvement, for dredging any shoal places, and removing any other obstructions to navigation that may develop.

July 1, 1908, balance unexpended	$1,733.06
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	21,733.06
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	205.40
July 1, 1909, balance unexpended	21,527.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a]35,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S S 3.)

4. *Stockton and Mormon channels, California.*—The act of June 13, 1902, provided for the diversion of the waters of Mormon Slough into the Calaveras River. The project is printed in the Annual Report of the Chief of Engineers for 1899, page 3189. Its estimated cost was $255,016. The full amount has been appropriated and the work is under construction. The act of 1902 required the city of Stockton to furnish the right of way to the United States, which was done.

This work is being done under continuing contract appropriations and the full balance of the authorization has been appropriated.

This canal will, however, not entirely prevent débris from being carried into Stockton channel from Mormon Slough. The south bank of this slough above the canal is low and at high water overflows. Until this south bank is leveed, part of the high water discharge of Mormon Slough will enter Stockton channel.

The total amount expended on existing project up to June 30, 1909, is $57,883.30. Of this amount nothing has been spent for maintenance of improvement and nothing has been received from any sales, etc.

During the year work has been carried on under two contracts, one on the Calaveras section of the diverting canal and the other on the canal section of the diverting canal. The work on the first section was about four-fifths completed at the end of the fiscal year, and the latter section was about one-tenth completed. The work on both sections consists of clamshell dredging, dry work by land dredges, building levees, embankments, and dams, and also raising and extending old highway and railroad bridges, and building the necessary new bridges in the path of the diverting canal.

---

[a] This amount includes an item of $5,000 for maintenance of Stockton and Mormon channels after completion of the improvement now in progress.

July 1, 1908, balance unexpended	$222,360.31
Amount appropriated by sundry civil act approved March 4, 1909	56,079.00
	278,439.31
June 30, 1909, amount expended during fiscal year, for works of improvement	55,927.61
July 1, 1909, balance unexpended	222,511.70
July 1, 1909, outstanding liabilities	4,982.82
July 1, 1909, balance available	217,528.88
July 1, 1909, amount covered by uncompleted contracts	152,877.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	([a])

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix S S 4.)

5. *Mokelumne River, California.*—The navigable portion of this river is a tidal stream emptying into the San Joaquin River. It is navigable for 20 miles above its mouth, and with its branches or forks about 14 miles additional. It also connects with other navigable sloughs forming the delta of the San Joaquin and Sacramento rivers. Regular lines of steamboats go to New Hope Landing, about 14 miles above the mouth. Motor boats go above regularly and steamboats go occasionally to the New Hope-Galt Bridge to bring in supplies and take out the crops. Six feet at low tide is found as far as Snodgrass Slough, 13 miles above the mouth. Above that are found shoals 3 to 4 feet in depth. The tidal range is about 3 feet. The difficulties of navigation have been mostly due to snags and overhanging trees.

The first project was made in 1881 for their removal at an estimated cost of $8,250. (See Annual Report, Chief of Engineers, 1882, p. 2637.) The project was enlarged in 1891 to include, beyond snagging, the closing of a small canal and removing, by dredging, a tongue of land opposite New Hope Landing. The estimated cost to put the river in navigable condition was $7,100. (See Annual Report, Chief of Engineers, 1891, p. 3135.) Appropriations were made in 1892 and 1894, amounting to $5,000, and the work of closing canal and removing point was completed. No appropriations were made between 1894 and 1905. Since then the amounts appropriated have been used for maintenance by snagging, dredging small bars, and cutting off sharp points. The balance now available will be applied, as above, for maintenance.

The total amount expended on this improvement to June 30, 1909, was $20,392.24.

---

[a] See money statement for San Joaquin River, page 827.

The improvement has resulted in a reduction of freight rates. There have been no records kept of the tonnage on this river. It is estimated by various parties as between 50,000 and 100,000 tons. This is largely carried by scow schooners on irregular trips. The steamboat company operating on the river gives the amount of tonnage carried by its steamers as 25,284 tons, at an estimated value of $1,800,000. The imports are lumber, coal, live stock, and merchandise; the exports, grain, flour, fruit, vegetables, and other produce.

The amount estimated for the fiscal year 1911 will be used on dredging bars and snagging, for maintenance of improvement.

July 1, 1908, balance unexpended	$2,625.76
June 30, 1909, amount expended during fiscal year for maintenance of improvement	18.00
July 1, 1909, balance unexpended	2,607.76
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S S 5.)

6. *Petaluma Creek and Napa River, California.*—(*a*) *Petaluma Creek.*—This creek has a length of 16 miles and is an estuary of San Pablo Bay. Its head of navigation is the town of Petaluma, a place of about 4,000 inhabitants.

Before improvement it was very crooked, dry in many places at low tide, and could be navigated only at medium or high-tide stages.

Project was made in 1880 for straightening the creek by making cut-offs and dredging so as to obtain a channel 50 feet wide and 3 feet deep at low water, estimated to cost $25,868. (See Annual Report of the Chief of Engineers for 1880, p. 2243.) In 1892 the project was extended to dredge the channel as deep as funds would permit. Work has been done under the project as funds were appropriated. The project was enlarged by the river and harbor act of March 2, 1907 (see H. Doc. No. 387, 59th Cong., 1st sess.), to provide for dredging a channel 6 feet deep at low tide and 50 feet bottom width from the mouth of the creek to McNears Canal, and 4 feet deep and 50 feet wide thence to the head of navigation at Petaluma. The additional cost of this work is estimated at $15,239, which was appropriated March 2, 1907.

Under contract completed October 21, 1908, a channel 50 feet wide and 6 feet deep, mean low water, was dredged up to McNears Canal, and 50 feet wide and 4 feet deep to head of navigation at Petaluma.

In March, 1909, it was found that, due to heavy floods, the channel above McNears Canal had shoaled its entire length, and for 1½ miles below the canal had shoaled in several places. With funds available an emergency contract was entered into April 1, 1909, and with funds subsequently available a second emergency contract was made May 24, 1909. Under these contracts, which were almost completed June 30, a channel 3 to 4 feet deep was dredged from the lower part of Petaluma City to within 2,000 feet of the head of navigation. It is proposed to continue dredging so as to obtain dimensions of channel in accordance with approved project in the near future.

In October, 1908, complaint was made of shoaling in San Pablo Bay across the flats at the entrance to Petaluma Creek. An examination was made and a survey found necessary to determine the extent of shoaling. An examination was accordingly made over an area of 2 miles wide and 5 miles long, and the examination showed that the original channel across the flats was practically obliterated, so that there was an available depth in the shoalest part of only about 2½ feet at the mean of lower low water. There is no project to cover improvement at this place, which, being in San Pablo Bay and exposed to the winds and waves, will be very costly.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part is 3 to 4 feet, except the upper 2,000 feet, where the creek is about dry at low water. Navigation is carried on only at higher stages of the tide. The usual tidal range is about 8 feet.

The amounts available and estimated for the fiscal year 1911 will be used for dredging and snagging, and are for maintenance.

The total amount expended to June 30, 1909, is $85,593.61.

The amount spent on the existing project up to June 30, 1909, is $17,785.09. Of this amount, $475 has been spent for maintenance of improvement. Nothing has been derived from sales or other sources.

A new transportation line, the Petaluma Transportation Company, has been established during the year. This company operates the steamer *Resolute* between Petaluma and San Francisco.

The commerce on Petaluma Creek is large. The statistics have been carefully collected by the Chamber of Commerce of Petaluma. There are 2 steamers running regularly the whole year, and 1 for about five months, besides over 60 schooners making trips more or less regularly as they find freight. The exports and imports by the river are given at 155,000 tons, valued at over $8,000,000. Commerce by railroad is given as 100,000 tons, valued at $4,500,000. It is considered that water transportation has aided largely in the development and prosperity of the contiguous country and has materially affected freight rates.

July 1, 1908, balance unexpended		$13,796.34
Withdrawn from Napa River and allotted for Petaluma Creek		2,000.00
Amount allotted from appropriation by river and harbor act approved March 3, 1909		10,000.00
		25,796.34
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$13,675.95	
For maintenance of improvement	475.00	
		14,150.95
July 1, 1909, balance unexpended		11,645.39
July 1, 1909, amount covered by uncompleted contracts		3,483.35
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

---

[a] See consolidated money statement on page 832.

(*b*) *Napa River.*—Before improvement this river had a low-water depth of 5 feet for about 12 miles above the Mare Island Navy-Yard and about 1 foot depth on the crest of the bars in the next 4 miles of its length to the head of navigation in front of the town of Napa. The ordinary range of tides is about 5 feet. Spring tides reach a height of 7 feet.

Project for the improvement was made in 1888, which contemplated the dredging of the bars and cutting off projecting points of land so as to obtain a channel 75 feet wide with a least depth of 4 feet at low tide and to remove logs, snags, and other obstructions. The estimated cost was $27,600. Examinations were again ordered by Congress and made in 1896, 1899, and 1902. Report on the latter is printed in the Annual Report of the Chief of Engineers for 1904, page 3427.

Navigation on the river is possible and profitable only at medium and high stages of the tide. The existing project and old project are identical.

Work was begun in accordance with the project in 1889 and has progressed since whenever funds became available.

The total amount expended on this improvement to June 30, 1909, is $37,177.64. Of this amount, $9,577.64 has been spent for maintenance of improvement. Nothing has been derived from sales or other sources.

The only work done during the fiscal year was removing a large snag from the draw of the bridge at Napa, and also removing some old piles and stumps from the river. The total amount spent during the fiscal year was $123 55.

The heavy rains and floods of the past winter have caused considerable shoaling in the channel, so that there is now not over 1 foot of water at low water over some of the bars. The exact condition of the channel is not known and a survey will be necessary to determine the amount of shoaling. Dredging will be necessary in this channel within the next few months.

The maximum draft that can be carried June 30, 1909, at mean low water over the shoalest part is 1 foot.

The amounts available and estimated for the fiscal year 1911 will be used for dredging and snagging, and are for maintenance.

Freight rates are reasonable, due to the maintenance of navigation.

The commerce of Napa River during the year 1908 amounted to 207,880 tons, the value not being given. This commerce was all carried by the steamers and schooners of one transportation company.

July 1, 1908, balance unexpended	$4, 875. 27
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5, 000. 00
	9, 875. 27
Withdrawn and allotted to Petaluma Creek, California	2, 000. 00
	7, 875. 27
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	123. 55
July 1, 1909, balance unexpended	7, 751. 72

Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a]
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CONSOLIDATED.

July 1, 1908, balance unexpended		$18,671.61
Amount allotted from appropriation by river and harbor act approved March 3, 1909		15,000.00
		33,671.61
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$13,675.95	
For maintenance of improvement	598.55	
		14,274.50
July 1, 1909, balance unexpended		19,397.11
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909		20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix S S 6.)

7. *Humboldt Harbor and Bay, California.*—A description and history of the work done at this locality is printed in the Annual Report of the Chief of Engineers for 1900, page 4237.

Before improvement the entrance to the harbor was obstructed by a bar having channel depths of 12 to 15 feet. This channel was not fixed in direction, and sometimes for weeks at a time vessels were bar bound. Inside the harbor, in front of the towns of Eureka, Arcata, and Hookton, the channels were very shoal.

In 1881 project for deepening the channels in front of these towns by dredging was adopted. (See Annual Report of the Chief of Engineers for 1881, p. 2481.) The work was done by contract, was completed in 1884 at a cost of $80,884.69, and resulted in channels 200 feet wide and 12 feet deep in front of Eureka and 100 feet wide and 10 feet deep in front of Arcata and Hookton.

In March, 1899, project was adopted for dredging a channel 15 feet deep, 200 feet wide, and 8,900 feet long in front of Eureka, estimated to cost $50,000. Work was done by contract, and a channel of the dimensions contemplated was completed in March, 1901.

By act of March 2, 1907, Congress appropriated for a project for further improvement in accordance with report printed in House Document No. 228, Fifty-ninth Congress, first session, which contemplated enlargement of the channel in front of Eureka to a depth of 18 feet and width of 300 feet for a length of 6,200 feet, at an estimated cost of $83,000. This was completed October 2, 1908.

In 1882 project for improving the entrance to the harbor was adopted. It called for a low jetty, estimated to cost $600,000, which was to be about 6,000 feet in length, to extend from the south spit seaward. This was somewhat modified in 1888 and again in 1891, so as to build nearly parallel high jetties, each about 8,000 feet in length, to extend seaward to the crest of the bar. The estimated cost of the work was $2,057,615.

---

[a] See consolidated money statement on this page.

The work on the jetties was commenced in 1889 and was completed in August, 1899, at a cost of $2,040,203.35. It resulted in a good channel, having a least depth of 28 feet at low water. A resurvey, made in August, 1903, showed a channel through the entrance having a least low-water depth of 31 feet. Since that time the channel has deteriorated. A bar has formed outside the entrance whose longer axis is nearly at right angles to the former jetty channel. The result is that vessels instead of going straight to sea, as formerly, now make a sharp turn to the right, broadside to the sea, immediately on passing the outer end of the north jetty.

This bar varies in location, and at certain times of the year the channel goes out nearly straight from the jetties, but with a decreased depth. In good weather the depth of water in the channel is sufficient for vessels entering and leaving the harbor. In rough weather it is dangerous and difficult.

The total amount expended on this work to June 30, 1909, is $2,261,662.99. Of this amount, $83,000 has been spent for improvement on the present project for the channel in front of Eureka. Nothing has yet been spent for maintenance on this project. The sum of $6 has been received from sale of unserviceable articles and deposited to credit of the appropriation.

On June 30, 1909, the depth of water at the entrance to the harbor is about 20 feet at extreme low water. At the wharves at Eureka it is about 18½ feet. To Arcata the channel in shallowest part has about 9.5 feet low water. There is no navigation to Hookton at present. The tidal range is about 5.5 feet.

Since the improvement the population of Eureka and vicinity has increased from 7,000 to about 16,153 persons. The commerce has increased. Deeper-draft vessels and more of them now run regularly to Humboldt Bay.

The following table shows the increase in the annual commerce since 1885:

	Passengers.	Freight.		Passengers.	Freight.
		Tons.			*Tons.*
1885	4,195	162,614	1906	35,423	706,549
1895	11,514	236,378	1907	32,617	834,634
1905	32,748	616,753	1908	31,537	601,787

The commerce for 1908 was about 500,000 tons exports, valued at $8,678,000, and 104,000 tons imports, valued at $4,363,000. There is a considerable decrease over the tonnage of 1907, which was given as a total of about 834,000 tons. This is due largely to the dull state of the redwood lumber market, which has affected all business. The principal article of export is lumber, and of import, general merchandise. The number of passengers was about 30,000. This will, of course, decrease when a railroad is completed to Eureka.

A feature of the commerce is the increasing amount of lumber sent to foreign ports and Hawaii. This amounted to 80,000 tons, carried in 43 vessels.

The improvements have undoubtedly lessened freight rates in that they have allowed larger vessels to enter harbor and decreased delays due to the bar.

July 1, 1908, balance unexpended	$91,612.80
Received from sale of augers, etc	6.00
	91,618.80
June 30, 1909, amount expended during fiscal year, for works of improvement	82,666.79
July 1, 1909, balance unexpended	8,952.01

(See Appendix S S 7.)

8. *Removing sunken vessels or craft obstructing or endangering navigation.*—During the month of August, 1908, the wreck of a clam-shell dredge (no name) was removed from Sycamore Slough, a tributary of the south fork of Mokelumne River, California, at a cost of $150.

(See Appendix S S 8.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination and survey of Suisun Channel, or Creek, California.*—Reports dated March 18, 1908, and August 24, 1908, respectively, are printed in House Document No. 1110, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $25,000 is presented.

2. *Preliminary examination and survey of San Francisco Harbor, California, with a view to removal of certain rocks.*—Reports dated June 18, 1907, and September 22, 1908, respectively, are printed in House Document No. 1119, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $170,000 is presented.

3. *Preliminary examination and survey of San Joaquin River, California, and its tributary, Stockton Channel, from San Francisco Bay to Stockton.*—Reports dated July 25, 1907, and October 6, 1908, respectively, are printed in House Document No. 1124, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $240,000 is presented.

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1909.

Report dated March 31, 1909, on preliminary examination of *Feather River, California, from the mouth to Marysville,* required by the river and harbor act of March 3, 1909, was duly submitted by a Board of Engineers. It was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and was transmitted to Congress and printed in House Document No. 76, Sixty-first Congress, first session. The locality is not considered worthy of improvement by the General Government in the interests of navigation

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND SAN FRANCISCO, CALIFORNIA, DISTRICT.

This district was in the immediate charge of Capt.Thos. H. Jackson, Corps of Engineers, under a Board of Engineers appointed pursuant to the provisions of act of Congress approved June 3, 1896. Division engineer, Lieut. Col. John Biddle, Corps of Engineers.

Sacramento and Feather rivers, California.—The first appropriation by Congress was "for the improvement of the Sacramento and Feather rivers, California." This appropriation was made March 3, 1875. At that time, due largely to the consequence of hydraulic mining, the depth on some of the bars in the Sacramento River in the 61 miles between its mouth, at Collinsville, and the city of Sacramento was but 4 feet, as compared with the depth of 7 feet which had previously existed. From Sacramento to Colusa, 91 miles, the stream was in favorable condition for navigation by boats drawing about 3 feet of water, but in the 110 miles from Colusa up to Red Bluff navigation was, as it is yet, difficult at numerous places on account of its changing and crooked channels, easily eroded banks, bars, and rapids. Many snags are also brought into this portion of the stream annually by high water. The bed of the Feather River had also been so filled up with débris from the hydraulic mines draining into it and its tributaries that navigation in the 30 miles between its mouth in the Sacramento and the head of navigation, at Marysville, was practicable during the higher stages only, usually extending from December to June. The same is true at the present time.

The present project for improvement (Reports of Board of Engineers printed in the Annual Reports of the Chief of Engineers for 1898, pp. 2944–2945, and for 1899, pp. 3171–3181) as adopted by the act of Congress approved March 3, 1899, and by subsequent acts, provides for obtaining and maintaining the following-named channel depths in the Sacramento River, by continuing the work of removing snags and other obstructions, and by the construction of wing dams to concentrate the flow at shoal places, at an estimated first cost of $280,000 and an annual expense of $25,000:

From—	To—	Miles.	Least channel depth to be obtained and maintained.
			Feet.
Mouth of river at Collinsville	Sacramento	61	7
Sacramento	Colusa	91	4
Colusa	Red Bluff	110	3
Total		262	

At the time the reports of the Board of Engineers above referred to were submitted the permanent improvement of the Feather River was not contemplated until the flow of sand and other mining detritus from the Yuba, Bear, and other tributaries should be stopped or the commercial interests involved became greater. Several appropriations have since been made, however, for the improvement of both the Sacramento and Feather rivers.

The sum of $943,286.62 was expended up to June 30, 1909, on both streams in the construction of wing dams, construction and operation of a snag boat and a snag scow, and the closing of several extensive breaks in the levees.

The expenditures have resulted in obtaining and maintaining the projected channel depths in the Sacramento from its mouth up to Colusa, and channel depths of 2 to 2½ feet from Colusa up to Red Bluff.

The expenditures during the fiscal year ending June 30, 1909, were for removing snags, cutting overhanging trees, dredging a channel through a bar about 3 miles below the city of Sacramento, and repairs to a snag boat.

The following statement shows the present conditions for purposes of navigation of the Sacramento and Feather rivers:

	Sacramento River.	Feather River.
Maximum draft that can be carried at low water.	San Francisco to Sacramento, 7 feet; Sacramento to Colusa, 4 to 5 feet; Colusa to Red Bluff, 2 to 2½ feet.	Mouth of river to Marysville, 1 to 2 feet.
Head of navigation.........	Red Bluff..................................	Marysville.
Length, in miles, of navigable portions.	Mouth to Sacramento, 61 miles; mouth to Colusa, 152 miles; mouth to Red Bluff, 262 miles.	Mouth to Marysville, 30 miles.

The extreme variation of level of water surface at Red Bluff is about 22 feet, at Collinsville about 8 feet. Tidal influence extends up the Sacramento River to about the city of Sacramento.

The Sacramento River is important as the means for transporting both freight and passengers, steamboats plying regularly all the year round between San Francisco and Colusa, 202 miles, and during about seven months of each year (December to June) between San Francisco and Red Bluff, 310 miles. The Feather River is navigated at irregular times by light-draft steamboats from its mouth up to Marysville.

The freight carried on the Sacramento River during the year ending December 31, 1908, was approximately 425,000 tons, consisting principally of general merchandise and fruit upstream, and grain, fruit, vegetables, cord wood, and brick downstream. Approximately 150,000 passengers were carried during the past year. The average tonnage for the past thirteen years has been about 425,000. The maximum tonnage carried was in 1892, when it amounted to 579,574 tons.

Extensive areas of the land along the Sacramento River are under a high state of cultivation. Practically all of the territory along the river is dependent entirely upon the stream as a means of transportation for passengers and freight. In some instances the lower rates of the steamboat lines are met by railroads between the few points where the two meet in competition. Several new steamboat lines, both freight and passenger, were established during the past year. The traffic on the Sacramento is now handled by 41 steamboats, 50 gasoline boats and launches, and 36 barges, and, in the lower portions of the stream, by a number of gasoline and sail schooners.

The existing project as adopted by Congress contemplates that the sum of $25,000 will be provided annually for the improvement of the Sacramento and Feather rivers. The $30,000 mentioned in the appended money statement as a profitable expenditure in fiscal year ending June 30, 1911, is necessary, in addition to the balance unexpended on June 30, 1909, to remove snags, bars, and other obstructions to navigation.

More extended information concerning the Sacramento and Feather rivers and their tributaries may be found in the document and reports referred to in the Annual Report of the Chief of Engineers for 1908 (pt. 1, p. 861) and in House Document No. 1123, Sixtieth Congress, second session.

Much of the country along a considerable portion of the Sacramento, Feather, and San Joaquin rivers and their tributaries is subject to widespread overflow during the winter and spring months of each year, the streams being unable to carry off the rainfall in the valleys and foothills and the melting snow in the mountains. Unrestricted hydraulic mining in earlier years has contributed largely to the difficulty by filling up the beds of the streams.

The interests of navigation, the problem of flood control, and the control and disposition of mine débris are all inseparably connected. These matters are in charge of the California Débris Commission, and that commission, in a report dated June 30, 1907 (printed in the Annual Report of the Chief of Engineers for 1907, pp. 2262–2269), in which the various questions are considered, states that dredging is considered the only feasible method of treatment.

SACRAMENTO AND FEATHER RIVERS.

July 1, 1908, balance unexpended	$19,693.69
Amount received from sales	30.50
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
	44,724.19
June 30, 1909, amount expended during fiscal year, for works of improvement	19,724.19
July 1, 1909, balance unexpended	25,000.00
Amount (estimated) required for completion of existing project	Indeterminate.
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

SACRAMENTO RIVER.

July 1, 1908, balance unexpended	$18,658.24
June 30, 1909, amount expended during fiscal year, for works of improvement	13,123.77
July 1, 1909, balance unexpended	5,534.47
July 1, 1909, outstanding liabilities	2,673.37
July 1, 1909, balance available	2,861.10
July 1, 1909, amount covered by uncompleted contracts	2,861.10

(See Appendix T T.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated August 6, 1907, and October 10, 1908, on examination and survey, respectively, of *Sacramento River, California, from its mouth to Feather River,* required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1123, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $67,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST PORTLAND, OREGON, DISTRICT.

This district was in the charge of Lieut. Col. S. W. Roessler, Corps of Engineers, division engineer, northern Pacific division, to July 11, 1908, and of Maj. J. F. McIndoe, Corps of Engineers, since that date, having under his immediate orders Capt. Arthur Williams, Corps of Engineers, since January 11, 1909. Division engineer, Lieut. Col. John Biddle, Corps of Engineers, temporarily.

1. *Coquille River, Oregon.*—The Coquille River rises in the Coast Range and empties into the Pacific Ocean at Bandon, Oreg., about 375 miles north of San Francisco. Before improvement the channel at the mouth skirted the south headland for some distance, as shown on map opposite page 2682 of the Annual Report of the Chief of Engineers for 1882, and was shoal, shifting, and studded with dangerous rocks. The depth over the bar was usually about 3 feet at low tide and was available only for small coasting vessels.

The original project for improvement was adopted in 1878, and provided for the construction of two converging, high-tide jetties, built of rubblestone, 800 feet apart, so located as to cause the river to empty into the sea about one-half mile north of the original mouth of the river, these jetties to run out to sea a sufficient distance to create and maintain a channel 12 feet deep at low tide. In 1880 the proposed depth of 12 feet at low tide was reduced to 10 feet; in 1888 it was reduced to 8 feet, and under date of May 8, 1891, the plan was changed to provide that the jetties should be 600 feet apart at their outer ends instead of 800 feet.

The amount expended on original and modified projects, prior to operations under existing modified project, was $144,323.42, including $6,883.90 for snagging and $15,000 for repairs and maintenance.

The above changes, and the limitation of the length of the south jetty to 2,700 feet and of the north jetty to 1,575 feet, by the act of July 13, 1892, constitutes the latest approved project. The estimated cost of the whole project, when completed, not including expenditures for maintenance, was $306,200.

The amount expended on the revised project to the close of the fiscal year ending June 30, 1909, was $206,063.22, of which amount approximately $40,661.06 was applied to maintenance.

The work accomplished during the year was the extension of the north jetty to its projected length of 1,575 feet. The tramway was extended seaward for a farther distance of 135 feet, and 8,587 tons of stone were dumped into the jetty. Since the completion of the work expenditures were applied to maintenance.

The approved project is completed. There is now a channel of 10 feet at low water and of sufficient width to accommodate the small coasting vessels which use it. The tide rises about 4.2 feet at Bandon, near the mouth, and coasting vessels can ascend the stream to Coquille City, about 25 miles above Bandon. Above Coquille City the channel is available for smaller craft for a farther distance of 12 miles, or to Myrtle Point. Logging is carried on extensively on the headwaters for distances of 30, 26, and 18 miles above Myrtle Point on the north, south, and middle forks, respectively.

The freight is loaded on small coasting vessels along the 25 miles between Bandon and Coquille City, and is usually taken to San Francisco. The total imports and exports during the calendar year amounted to 68,426 tons, valued at $1,375,938. The exports consist principally of lumber, live stock, and farm products, and the imports of general merchandise, machinery, etc.

The improvement accomplished increases the carrying capacity of vessels and has the effect of reducing freight rates on all shipments, as the ocean is the only available means of transporting the products to market.

No additional work is necessary to make the improvement available, and as the above project is completed no funds are required therefor. The available balance will be applied to care of plant and maintenance. A new project is printed as House Document No. 399, Sixtieth Congress, first session, and if adopted the whole amount of $27,840 should be appropriated.

For further information as to the original and modified project, reference is invited to the Annual Report of the Chief of Engineers for 1879, page 1806; 1892, page 2664; and 1897, page 3380. A report of survey of 1907 is printed as House Document No. 399, Sixtieth Congress, first session.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Calendar year.	Tons.	Estimated value.
1899	26,654	....	1904	60,944	$1,322,058
1900	30,727	....	1905	45,455	1,105,750
1901	32,975	....	1906	67,288	1,119,716
1902	37,458	....	1907	60,504	1,367,634
1903	48,249	....	1908	68,426	1,375,938

July 1, 1908, balance unexpended		$31,013.68
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$25,700.00	
For maintenance of improvement	700.32	
		26,400.32
July 1, 1909, balance unexpended		4,613.36
July 1, 1909, outstanding liabilities		55.00
July 1, 1909, balance available		4,558.36

(See Appendix U U 1.)

2. *Entrance to Coos Bay and Harbor, Oregon.*—Coos Bay is a tidal estuary on the Pacific coast, in Oregon, about 180 miles south of the Columbia River. Next to Humboldt Harbor, in California, it is the principal harbor between the mouth of the Columbia River and San Francisco. Before improvement there was a channel across the bar often of no greater depth than 10 feet at low water, and under the influence of the northwesterly winds and shifting sands the channel was unstable and followed the west side of the north spit in a tortuous course. At that time it was used by small coasting vessels.

The original project was approved by the Secretary of War November 24, 1879, and provided for the construction of a jetty from a point about 250 yards below Fossil Point on a line toward the east end of Coos Head, the structure to be of wood and stone, or stone, as should be found best. A total of $213,750 was expended on this project, and 1,760 feet of jetty were constructed.

The project now in force for increasing the bar depth to 20 feet was adopted by act of Congress approved September 19, 1890. The estimated cost was $2,466,412, and provided for the construction of a north jetty 9,600 feet long, and a slightly converging south jetty 4,200 feet long.

The expenditures on the present project to the end of the fiscal year ending June 30, 1909, amounted to $702,547.56, of which $177,548.12 was for maintenance. In addition to this upward of $50,000 has been expended on the inner harbor for a low-water depth of 12 feet to the town of Marshfield. The amount derived from sales, etc., is $264.04.

No active operations were in progress under the project for jetty construction during the year. The plant used during construction was cared for, and during March and April the work of planting Holland grass roots on the North spit for its reclamation was carried on, a total of about 53 acres being planted.

The commercial interests of Coos Bay raised a fund of $21,270.41, with which the U. S. dredge *Oregon* was towed from Portland to Coos Bay and operated from October 13, 1908, to April 30, 1909. Approximately 320,000 cubic yards of material were dredged during that time.

Dredging with available balance of former appropriation, which work was authorized by the act of March 3, 1909, was carried on from May 1 to the end of the fiscal year, a total of approximately 90,000 cubic yards being removed from the shoals in the vicinity of Marshfield.

This dredging has increased the depth over a part of the shoals, and has been a great benefit to the boats using the channel from the bar entrance to Marshfield.

The project depth of 20 feet was obtained in 1894, when the north jetty had been extended to a length of 9,520 feet. The south jetty has therefore not been built, and the improvement has been made at a fraction of the estimated cost. It has resulted in a permanent channel of from 17 to 22 feet depth at mean low tide, close to and parallel with the north jetty. The variation of the water levels on account of the tide is about 4.8 feet. Ocean-going vessels ascend the bay to the town of Bay City, immediately above Marshfield, and about 14 miles from the mouth, above which point there is about 50 miles of available navigation for boats of light draft. The logging industry is very extensive, and is carried on throughout the whole year, large quantities of logs being floated from the headwaters to the mills along the bay.

The principal products are coal, lumber, farm and dairy products, live stock, woolen goods, and salmon. During the calendar year 1908 this amounted to 176,239 tons, valued at $3,161,015. The imports, consisting of farm and mill machinery and miscellaneous merchandise, amounted to 40,392 tons, valued at $3,916,125.

The bay and ocean form the only means of transporting products to outside markets, and the improvement has the effect of increasing the carrying capacity of vessels using the channel, with a consequent decrease in freight rates.

No additional work is proposed or necessary under the above project.

Further work at this locality will depend upon the action by Congress on the new plan of improvement published in House Document No. 958, Sixtieth Congress, first session, which provides for securing such additional depth at the bar entrance as can be secured and maintained by dredging and without further jetty construction and for the excavation of a channel within the bay 18 feet deep at mean lower low water up to the town of Marshfield by means of the dredge *Oregon*. Of this new work the further dredging of the inner channel is considered of primary importance. It is recommended that any provision made for the adoption of this new project carry with it a total appropriation and authorization of not less than $400,000, $50,000 of this to be applied to the operation within the bay of the dredge *Oregon* and contingencies, and $350,000 to the purchase or construction of a new hydraulic seagoing dredge for work at the entrance and the necessary operating and contingent expenses. Of the total amount, $150,000 may be provided in the form of a contract authorization to be carried in the sundry civil act which will be approved not later than March 4, 1911.

For reports on examinations and surveys reference is invited to the Annual Reports of the Chief of Engineers for 1879, page 1791, and 1890, page 2936.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Calendar year.	Tons.	Estimated value.
1899	116,567		1904	136,958	$3,557,984
1900	104,294		1905	178,945	3,901,906
1901	97,500		1906	184,455	5,900,017
1902	122,232		1907	167,562	6,400,000
1903	135,178		1908	216,631	7,077,140

July 1, 1908, balance unexpended	$23,831.05
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	4,115.13
July 1, 1909, balance unexpended	19,715.92
July 1, 1909, outstanding liabilities	3,900.00
July 1, 1909, balance available	15,815.92

(See Appendix U U 2.)

3. Coos River, Oregon.—Coos River is the principal tributary of Coos Bay and empties into the bay at its head, opposite the town of Marshfield. At a point 5½ miles from its mouth the river divides into two branches, known as the "North" and "South" forks, up each of which tidal influence extends for about 8½ miles. Before improvement was commenced the small light draft-steamboats and launches plying between Marshfield and the head of tide on each fork experienced considerable difficulty in navigating on account of the many snags, bowlders, etc., in the stream.

The original and existing plan of improvement, based on the survey made in 1894 (Annual Report of the Chief of Engineers for 1895, pp. 3502–3505) proposed the removal of all snags and bowlders from a selected channel, 50 feet in width, in the main river and on both the North and South forks to the head of navigation. The estimated cost was $5,000, but in 1898 it was stated in the annual report that $3,000 additional would be required to complete the project, and in 1900 it was estimated that an appropriation of $1,500 every two years would be required for maintenance.

The amount expended on the project to June 30, 1909, was $14,336.30, of which $6,336.30 has been applied to maintenance.

No work was done during the fiscal year, as the channel was in fairly good condition and sufficient funds were not available to warrant repairing and putting the plant into commission.

The project may be considered as completed, and the work done has resulted in a safer and better channel for the small craft plying the stream. The maximum draft that can be carried at low tide over the upper reaches is about 1½ feet. The range of tide is about 2½ feet, so that boats drawing 4 feet navigate to the head of tide water on both the North and South forks, a distance of about 14 miles above the mouth. Logging from the extensive forests along the upper reaches of this stream is one of the main industries, and the logs are floated down to the booms in the lower reaches of the river and towed to the mills along the bay.

The valley is very fertile, and the commerce is mostly farm and dairy products, logs, and lumber. The produce is carried in small steamers to Marshfield, where it is loaded in ocean steamers and taken to the San Francisco and Portland markets. This traffic amounted during the calendar year 1908, including supplies, machinery, etc., received, to 36,697 tons, valued at $1,679,161.

The maintenance of the improvement is a benefit to navigation, and is essential to the economical and safe operation of steamboats.

The amount estimated as a profitable expenditure is for the purpose of snagging and dredging for maintenance of the improvement, and will be so applied.

For reports on examinations and surveys reference is invited to the Annual Reports of the Chief of Engineers for 1893, page 3437, and 1895, page 3502.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Calendar year.	Tons.	Estimated value.
1899	[a] 70,007		1904	49,907	$1,033,758
1900	[b] 229,225		1905	44,398	1,179,974
1901	62,402		1906	35,537	1,246,684
1902	[c] 46,000		1907	42,073	1,613,948
1903	28,109		1908	36,697	1,679,161

[a] Includes 21,852 tons of stone for the government jetty at the entrance to Coos Bay, Oregon.
[b] Includes 170,400 tons of stone for the government jetty at the entrance to Coos Bay, Oregon.
[c] Approximate.

July 1, 1908, balance unexpended	$1,663.70
July 1, 1909, balance unexpended	1,663.70
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix U U 3.)

4. Tillamook Bay and bar, Oregon.—Tillamook Bay is an indentation of the Oregon coast, about 6 miles long and about 3 miles wide, and lies about 50 miles south of the entrance to the Columbia River. At low tide the bay inside the bar is a succession of sand and mud flats, separated by several channels, which shoal to a low-tide depth of about 1 or 2 feet. The bar at the entrance to the bay has a controlling channel depth, generally, of about 14 feet at mean low tide. Vessels drawing from 14 to 15 feet can reach Hobsonville, on the north channel, a short distance inside the entrance. Originally the controlling high-water depth between the ocean and the town of Tillamook, on Hoquarten Slough, 12 miles from the entrance, did not exceed 7 or 8 feet.

The original project for the improvement was adopted by the river and harbor act of August 11, 1888, and provided for a survey of the entrance, and for the improvement of Dry Stocking bar and Hoquarten Slough, by the building of pile dikes, at an estimated cost of $5,200. The total amount expended on this project was $5,700.

The existing project adopted by the act of July 13, 1892, provided for connecting the north and middle channels nearly opposite Bay City, putting in dikes at Junction and Dry Stocking bars, and contemplated a least depth of 9 feet at mean high tide from Hobsonville to Tillamook City. The estimated cost was $100,000.

The amount expended on the existing project at the close of the fiscal year ending June 30, 1909, was $120,110.34, of which amount $47,636.97 was applied to maintenance. There was received from sales the sum of $20.

Snagging and dredging operations were in progress during the summer and fall of 1908, were commenced again in June, and are still in progress, with a view to maintaining the projected depth of 9 feet to Tillamook City.

All of the work contemplated by the project has been completed, and, except as shoals are formed by each freshet, boats have experienced little difficulty in reaching Tillamook City at high tide on a draft of 9 feet. The average range of tide is 6.2 feet. The head of navigation for ocean-going vessels is at Tillamook City, about 12 miles from the entrance.

Lumbering is one of the chief industries, and logging is extensively carried on, most of the tributaries of Tillamook Bay being utilized as a means of floating the logs down to tide water.

The commerce on Tillamook Bay consists of lumber and dairy products shipped to Portland and San Francisco, and general merchandise brought in by coasting vessels. During the calendar year this traffic amounted to 19,400 tons, valued at $1,098,990.

There is no railroad connection with Tillamook Bay, but construction has been started on a projected line beginning at Hillsboro, just west of Portland, and which is intended to connect the Southern Pacific with a terminus on Tillamook Bay.

The amount estimated as a profitable expenditure is for maintenance by dredging and snagging, and the work is necessary to make the improvement available for vessels drawing 9 feet at high tide.

For reports on examinations and surveys, attention is invited to Annual Reports of the Chief of Engineers for 1888, page 2150; 1892, page 2742; 1898, page 3007; and 1903, p. 2239. The report of survey made in 1907 is published as House Document No. 965, Sixtieth Congress, first session.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Calendar year.	Tons.	Estimated value.
1899	36,835		1904	13,823	$658,489
1900	17,640		1905	13,919	696,760
1901	21,147		1906	13,627	850,240
1902	24,883		1907	22,917	1,246,710
1903	16,862		1908	19,400	1,098,990

July 1, 1908, balance unexpended	$2,480.83
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	7,480.83
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	2,571.17
July 1, 1909, balance unexpended	4,909.66
July 1, 1909, outstanding liabilities	2,176.00
July 1, 1909, balance available	2,733.66
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix U U 4.)

5. *Improving the various harbors on the coasts of Oregon and Washington by the construction and equipment of a dredging plant for use thereon.*—The river and harbor act of March 2, 1907, appropriated $100,000 for the construction of this dredging plant, and a contract was entered into under date of January 24, 1908, for the construction

of an 18-inch hydraulic dredge in accordance with plans and specifications. The contract price was $79,340, not including equipment. The total cost of the dedge was finally increased by the purchase of equipment and extra parts to the full $100,000 appropriated. The dredge hull is 120 feet long, 36 feet wide, and 11 feet deep. The dredge was finished and turned over to the United States by September 10, 1908, and named *Oregon.* The amount expended on construction of this dredge was $98,502.58.

There being no government funds available for the operation of the dredge, and dredging being very essential in the inner harbor of Coos Bay, commercial interests in that vicinity petitioned the department for permission to use the dredge in deepening the channel up to the town of Marshfield. Permission was granted to use the dredge without expense to the United States, and the dredge was towed to Coos Bay and commenced operations in October.

In crossing the bar at the entrance to Coos Bay some damage was caused to the smokestacks and rigging, and after arrival at North Bend she settled on a submerged pile, at low tide, and sunk. She was afterwards raised, with some difficulty, and repaired.

The dredge has proven a very capable and satisfactory piece of plant. Details of her operations will be found in the report for improving entrance to Coos Bay and Harbor.

July 1, 1908, balance unexpended	$65, 539. 73
June 30, 1909, amount expended during fiscal year, for works of improvement	64, 042. 31
July 1, 1909, balance unexpended	1, 497. 42
July 1, 1909, outstanding liabilities	1, 497. 42

(See Appendix U U 5.)

6. *Snake River, Oregon, Washington, and Idaho.*—The portion of the river under improvement extends from its junction with the Columbia to Pittsburg Landing, a distance of about 216 miles. The upper portion runs through a mountainous country and is much obstructed by gravel shoals, ledges of bed rock, bowlders, and numerous rapids. The country through which the river passes, between Riparia and its mouth, is more open, but navigation is difficult, owing to the swift current and numerous rapids. Some of the channels through the rapids are narrow and crooked, and before improvement were practically impassable at low water, owing to the rocky ledges, gravel shoals, and bowlders. The Snake and Columbia rivers, in early days, formed the natural highway for the traffic between the inland empire and the Pacific coast, and navigation on the Snake River, notwithstanding the difficulties, continued until the completion of the railroad to Riparia in 1882, after which boats abandoned the river below that point.

A detailed description of the river prior to, and during, the early years of improvement will be found in the Annual Report of the Chief of Engineers for 1880, page 2293, and 1891, page 3212.

In 1877 a project was approved for removing reefs and bowlders and for scraping gravel bars in the Columbia and Snake rivers between Celilo, Oreg., and Lewiston, Idaho, a distance of 263 miles, at an estimated cost of $132,000. Since 1882 operations on the Snake River have been confined to the stretch above Riparia. In 1892 the project was extended to include the improvement of the 7 miles of river between Lewiston, Idaho, and Asotin, Wash., and the act of June 13, 1902, further provided for extending the improvement to Pittsburg Landing. The project now provides for completing and maintaining the improvement between Lewiston and Riparia, with a view to obtaining a low water depth of 5 feet, by means of blasting, dredging, raking, and by contraction works, and for general improvement up to Pittsburg Landing. The work between Riparia and Pittsburg Landing is based on surveys made in 1900, 1902, and 1906, between Riparia and Lewiston, between Lewiston and Imnaha River, and between Imnaha River and Pittsburg Landing, at an estimated cost of $23,000, $33,690, and $15,000, respectively.

In 1907 the Washington State legislature appropriated $100,000 for expenditure between Riparia and the mouth. This action was the result of a general disposition to revive navigation below Riparia and utilize the State Portage road, which was built in 1905, around the obstructions in the Columbia between Celilo and Big Eddy. The project for this portion of the river, which was formulated for the especial purpose of expending the above-mentioned appropriation, is based on the survey made in 1897, and is a continuation of general open river work.

The amount expended on the original and modified projects to the close of the fiscal year was $262,003.99, under the national appropriation, and $74,164.06 under appropriation made by the State of Washington.

There has been received from miscellaneous sources, on account of sales, $825.70.

Operations during the past year have been carried on by the dredge *Wallowa*, belonging to the United States, and by two drill scows previously constructed under state funds. The dredge *Wallowa* operated both above and below Riparia, the two drill scows being confined to work below Riparia. Owing to severe weather and ice gorges, both drill scows were wrecked in January, one being a total loss, and the other picked up and towed back with little damage. A total of 3,482 cubic yards of rock were removed from the different reefs and rapids below Riparia, and 1,485 tons of stone were placed in the dam at Slaughterhouse Rapids, just above Lewiston.

The work done has resulted in providing a low-water channel between Lewiston and Riparia of about 40 inches, in greatly improving the conditions above the latter point, and in making a safer and more available channel below Riparia for all except extreme low stages.

The Snake River is in freshet during the summer months from melting snow in the mountains, and during these freshets the variation of the water levels is usually about 20 feet. The head of navigation, during proper stages, is at Pittsburg Landing, about 216 miles above the mouth, but only intermittent trips are made to that point, regular traffic being carried on only as far up as Lewiston. There is no logging or rafting on the Snake River, but logs are floated down the Clearwater River to the mills near Lewiston.

The Open River Transportation Company, a corporation organized for the purpose of navigating the river, is now operating a line of boats between Portland, Oreg., and Big Eddy, and have constructed two powerful, light-draft boats, the *Inland Empire* and *Twin Cities* for use on the upper river. These latter boats run between Lewiston and Celilo, and exchange cargoes with the lower river boats by means of the State Portage road between Celilo and Big Eddy.

The Oregon Railroad and Navigation Company, which in former years operated boats between Lewiston and Riparia, partially abandoned the use of the river on completion of their railroad along the north bank to Lewiston during the past year, but owing to the keen competition set up by the new line of boats they are again operating.

The commerce transported on the Snake River during the fiscal year amounted to 46,325 tons, and consisted principally of farm and mill machinery, grain, fruit, and general merchandise, valued at, approximately, $1,251,335.

The reestablishment of water transportation between Lewiston and Portland has resulted in a reduction in freight rates of about 20 per cent between those points.

The amount estimated as a profitable expenditure for the next fiscal year will be applied to the removal of obstructions, for maintenance and improvement, and the proposed work is essential in order to make the improvement available.

For earlier reports on examinations and surveys, attention is invited to Annual Reports of the Chief of Engineers for 1877, page 1036; 1882, page 2716; and 1885, page 2440. Reports of surveys covering several sections now under improvement, with estimates of cost, will be found in the annual reports as follows: Between Riparia and the mouth, 1898, page 3013; between Riparia and Lewiston, 1901, page 3525; between Lewiston and the mouth of Imnaha River, 1903, page 2246; between Imnaha River and Pittsburg Landing, 1906, page 1986.

Comparative statement of traffic carried on Columbia River above Celilo and on Snake River during year ending December 31, 1908.

Calendar year.	Columbia River above Celilo.	Snake River.	Total.	Estimated value.
	Tons.	*Tons.*	*Tons.*	
1899			45,654	
1900			35,920	
1901			36,723	
1902			37,824	
1903			44,379	
1904			43,547	$1,798,677
1905			28,380	1,191,960
1906			71,556	2,671,882
1907	7,776	39,228	47,004	1,880,300
1908	1,349	46,325	47,674	1,296,750

FEDERAL APPROPRIATION.

July 1, 1908, balance unexpended	$4,258.38
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	9,258.38
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	3,892.26
July 1, 1909, balance unexpended	5,366.12
July 1, 1909, outstanding liabilities	278.00
July 1, 1909, balance available	5,088.12

Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	$15,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

STATE APPROPRIATION.

July 1, 1908, balance unexpended	$52,622.69
June 30, 1909, amount expended during fiscal year, for works of improvement	26,786.75
July 1, 1909, balance unexpended	25,835.94
July 1, 1909, outstanding liabilities	337.00
July 1, 1909, balance available	25,498.94

(See Appendix U U 6.)

7. *Columbia River and tributaries above Celilo Falls to the mouth of the Snake River, Oregon and Washington.*—This stretch of river is 124 miles long and can be navigated at favorable stages. It abounds in rapids and shoals which are obstructed by projecting ledges, isolated bowlders, etc. Before the days of railroads the Columbia River formed the main highway for commerce between the inland empire and tide water, but navigation was always more or less dangerous, and was practically suspended in 1882 on account of the construction of a line of railroad by the Oregon Railroad and Navigation Company, which practically paralleled the south bank and reached as far as Riparia on the Snake River, about 72 miles below Lewiston.

The first project was adopted by act of June 10, 1872, and in 1877 was modified to include the improvement of the Snake River. This project provided for the improvement of the most troublesome rapids by the removal of obstructing reefs and bowlders, and in this work approximately $120,000 was expended up to the time of the suspension of navigation in 1882.

The existing project is based on the survey authorized by act of March 3, 1905, and was adopted by act of March 2, 1907. It proposes to facilitate navigation by the removal of obstructing bowlders and ledges, and raking the gravel shoals in order to make safe and available the channel that now exists. In 1907 the State legislature of Washington appropriated the sum of $25,000 for expenditure in the vicinity of Umatilla Rapids, in order to expedite the work under the general project.

The amount expended on the present project to the end of the fiscal year under the national appropriation was $83,653.51, and under the appropriation by the State of Washington $25,000.

With the drill scow previously constructed under funds appropriated by the State of Washington the work of blasting out obstructions at Umatilla Rapids was continued when conditions were favorable. The stern-wheel steamboat under construction at the beginning of the year was completed and equipped with drilling apparatus and appliances for raking shoals and put into commission the latter part of November. Work continued until May, when operations were suspended owing to high water. During the year 1,047 cubic yards of rock were removed from Umatilla, Biggs, and Homly rapids, and 537 drags were made at Biggs and Homly rapids.

The work accomplished has resulted in improving the channel through some of the most troublesome shoals, mainly Umatilla and Homly rapids, and has lessened, to some extent, the dangers that previously existed. During the summer months the river is in freshet, and the extreme variation of the water surfaces at that time is about 34 feet above low water. The head of low-water navigation for boats using this portion of the stream is at Asotin, on the Snake River, 269 miles above Celilo, and approximately 473 miles from the sea. On higher stages boats ascend the Snake River as far as Pittsburg Landing, a farther distance of about 70 miles. There is no logging on this stretch of river.

During the previous year there was but one small steamboat operating on the river between Celilo and the mouth of the Snake River. During the past year the Open River Transportation Company constructed two light-draft, powerful steamboats, the *Inland Empire* and *Twin Cities*, and these two boats are now being operated between Celilo and Lewiston in conjunction with steamers between Portland and Big Eddy. The cargoes are broken at Big Eddy and at Celilo and are transported around the obstructions between these two points by the State Portage road.

The freight rates charged by these boats on shipments from Portland, Oreg., to Lewiston, Idaho, are on an average about 20 per cent less than the rates charged for shipments by rail.

The amount estimated as a profitable expenditure for the fiscal year 1911 is to be applied to extending the benefits by continuing the work of removing obstructions. With the new plant now available, and with ample funds to operate it, better results may be expected. It is therefore essential that the whole amount be appropriated.

A description of the early conditions will be found in the Annual Report of the Chief of Engineers for 1877, page 1036, and the report of examination and survey for present project is printed as House Document No. 440, Fifty-ninth Congress, second session.

FEDERAL APPROPRIATION.

July 1, 1908, balance unexpended	$85,948.90
June 30, 1909, amount expended during fiscal year, for works of improvement	49,602.41
July 1, 1909, balance unexpended	36,346.49
July 1, 1909, outstanding liabilities	2,080.00
July 1, 1909, balance available	34,266.49
Amount (estimated) required for completion of existing project	280,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	90,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

STATE APPROPRIATION.

July 1, 1908, balance unexpended	$11,840.34
June 30, 1909, amount expended during fiscal year, for works of improvement	11,840.34

(See Appendix U U 7.)

8. *Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls, Oregon and Washington.*—The object of this improvement is to overcome the obstructions in the 12 miles between the foot of Threemile Rapids and the head of Celilo Falls. There are four principal obstructions: Threemile Rapids, a crooked channel 1,500 feet in length, narrow and obstructed by rocks and currents; Fivemile Rapids (The Dalles) where for 1½ miles the river rushes with great velocity between precipitous walls of basalt 150 to 300 feet apart; Tenmile Rapids, a similar gorge, but only one-half mile in length; Celilo Falls, with a sheer fall of 20 feet. The total fall is about 81 feet at low water and 60 feet at high stages. It can not be navigated at any stage.

The first project was adopted by act of August 18, 1894, and contemplated the construction of a boat railway capable of transporting boats of 600 tons. One hundred thousand dollars was appropriated for purchasing the right of way and beginning construction. The act of June 3, 1896, made an additional appropriation of $150,000. A preliminary examination and survey was authorized by act of June 6, 1900, with a view to the construction of a canal and locks. The report submitted under this act is printed in the Annual Report of the Chief of Engineers for 1901, Part 5, page 3502, and proposes the construction of a short canal and locks around The Dalles, or Fivemile Rapids, and another around the falls at Celilo, with intermediate river improvement, at an estimated cost of $3,969,371. The amount expended on previous projects prior to the adoption of the present project was $27,112.83.

The existing project, as adopted by Congress in the act approved March 3, 1905, provides for a continuous canal on the Oregon shore, between the pool above Celilo and the pool below Fivemile Rapids, with open river improvement at Threemile Rapids. As subsequently modified in minor details, the canal will have a depth of 8 feet, width of 65 feet at the bottom, and length of 8½ miles, with 5 locks 300 feet by 45 feet by 7 feet over miter sills, two of which will be located at the lower end of the canal, one at Fivemile Rapids, one at Tenmile Rapids, and one at Celilo Falls. As modified, the estimated cost will be $4,845,000.

The open river work at Threemile Rapids, which was included in the project, has been previously considered completed, but investigations in 1908, based on the complaints of steamboat men, make it apparent that further work will be required in order to furnish a safe channel at least 200 feet in width.

There has been expended on the work at Threemile Rapids approximately $120,000, and it is estimated that the additional work will cost about $45,000, thereby increasing the cost of the Threemile Rapids section by about $15,000. It is believed this increased cost will not necessitate any change in the estimated cost of the project as a whole, on account of the large amount estimated for engineering, etc.

The amount expended on the present project to the end of the fiscal year was $642,355.20, of which $31,279.81 was applied to surveying, preparing plans, etc., before its adoption. There has been received on account of the sale of blueprints the total sum of $39.08.

Under contract let in 1904, and completed in March, 1908, there were removed 50,970 cubic yards of rock from the rocky ledges in the vicinity of Threemile Rapids, in order to give a channel at least 10 feet deep at low water, and from 200 to 250 feet wide. Additional work may be necessary at this locality in order to provide a safe channel for steamboats.

Work has been in progress during the year under two contracts, one for about 2,500 feet of canal at the upper end, and one for the construction of a second section about 14,000 feet in length immediately below and adjoining the first section. At the close of the year the former contract was nearly completed, and the latter contract is about 35 per cent completed. At the close of the year work under these contracts was entirely suspended, owing to the summer freshet, and can not be resumed again until July or August.

This work has been carried on under continuing contract appropriations, the sundry civil act of March 4, 1909, having appropriated the sum of $164,000, which was the balance of the authorization made by the act of March 2, 1907.

With the completion of the contracts now in force, it might be stated that the project is about 20 per cent completed, but no advantages have been derived from the expenditures, except the benefit furnished by the improvement at Threemile Rapids. The variation of the water surfaces from extreme low water and extreme high water is from 32 to 90 feet at different points. Boats are now operating between Portland and Big Eddy, and between Celilo and Lewiston, 265 miles above Celilo on the Snake River, the cargoes being transported around the obstructions between Big Eddy and Celilo by the State Portage Railroad, thus furnishing water competition to all intermediate points on the river.

The Open River Transportation Company, organized for the purpose of operating boats in connection with the State Portage Railroad, has, during the fiscal year, constructed two steamboats with a carrying capacity of about 250 tons each, and during the calendar year 1908 they report the handling of approximately 4,056 tons of merchandise, farm and mill machinery, wheat and farm products, valued at approximately $207,685.

The influence of this water transportation has resulted in the reduction of freight rates between competitive railroad points up to Celilo, and as the steamboat service on the upper river is increased a still further reduction is anticipated. The benefits to be derived from the improvement when completed, the country which will be affected, and the probable resources to be developed are all described in House Document No. 228, Fifty-sixth Congress, second session. The irrigation projects now under way and contemplated should, within a few years, increase the farm products and the resultant traffic to very large quantities.

The amount estimated as a profitable expenditure will be applied to further work under contract, and it is recommended that the work be again placed on a continuing contract basis, with an authorized expenditure of approximately $1,000,000 per year until the work is completed.

The Spokane, Portland and Seattle Railroad has completed its bridges over the Columbia and Willamette rivers, giving entrance to the city of Portland, and making a new transcontinental line along the north bank of the Columbia, connecting with the Northern Pacific at Kennewick, Wash.

For reports on examinations and surveys, reference is invited to the Annual Reports of the Chief of Engineers for 1875, Part 2, page 787; 1882, page 2690; 1890, page 3428; 1894, page 2664; 1901, page 3501, and 1904, page 3475.

Comparative statement of traffic handled by Oregon State Portage Railway between Big Eddy and Celilo, Oreg.

Calendar year.	Tons.	Estimated value.	Calendar year.	Tons.	Estimated value.
1905	3,058	$185,800	1907	4,600	$185,000
1906	5,414	227,900	1908	4,056	207,685

July 1, 1908, balance unexpended	$666,765.10
Amount appropriated by sundry civil act approved March 4, 1909	164,000.00
Received account sales	24.23
	830,789.33
June 30, 1909, amount expended during fiscal year, for works of improvement	250,218.28
July 1, 1909, balance unexpended	580,571.05
July 1, 1909, outstanding liabilities	38,000.00
July 1, 1909, balance available	542,571.05
July 1, 1909, amount covered by uncompleted contracts	377,173.00
Amount (estimated) required for completion of existing project	3,708,392.64
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	1,000,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U U 8.)

9. *Canal at the Cascades, Columbia River, Oregon.*—This improvement embraces about 4½ miles of the Columbia River where it passes through the Cascade Mountain Range, and is contracted into a narrow gorge with steep slopes and swift current. A fall of 24 feet at low water in the upper 2,500 feet of the gorge creates a turbulent rapid which effectually bars upstream navigation and renders downstream navigation unsafe. The lower 4 miles of the gorge is swift, and before improvement was unsafe by reason of the obstructing ledges and bowlders.

The original project was for a canal and locks around the falls. It was adopted in 1877 and modified in 1886 and 1888, and included the improvement of the rapids below the falls to secure a low-water channel of 8 feet. The locks were to be about 462 feet long and 92 feet wide, with a low-water depth of 8 feet over the miter sills.

The existing project is a modification of the original project, and is based on report of the Board of Engineers, printed in the Annual Report of the Chief of Engineers for 1895, page 3571. It provided for utilizing the upper 426 feet of the uncompleted canal above the lock gates as a second lock, and also in raising the protection work of the canal walls as a safeguard against flood water. The estimated cost of the original project was $2,544,545, and the later modification $413,360.

The amount expended on the original and modified projects to the close of the last fiscal year was $3,819,875.63. There has been received on account of sales the total sum of $11,629.48.

No work was done during the fiscal year except to care for the plant and buildings, as sufficient funds for construction work were not available.

The canal and locks were completed and opened to navigation in 1895. There yet remains the building of the land wall of the upper lock, construction of three sets of steps, and completing the paving and grading on the land side of the canal. Provision should also be made for blasting out some obstructive ledges below the locks. About 8 feet can be carried at low water through the locks. An annual rise in the Columbia River takes place in May, June, or July, and usually reaches a stage of 40 feet above low water. The head of navigation for boats passing the locks is Big Eddy, about 4 miles above The Dalles. No logs are rafted through the canal, but logging is carried on extensively between Cascade Locks and The Dalles.

The downriver commerce through the locks consists of wheat, flour, miscellaneous grain, cattle, horses, wool, and country produce. The amount of this commerce was 17,687 tons, valued at approximately $1,060,600. The upriver commerce is principally general merchandise, machinery, and supplies, and during the year amounted to 16,490 tons, valued at approximately $989,400.

This improvement is a factor in regulating freight rates to all points reached by steamers using the canal and locks.

The amount estimated as a profitable expenditure will be applied to blasting out obstructions below the locks and in completing the masonry work. The proposed work is not necessary to make the improvement available, but is essential in order to decrease the volumetric capacity of the upper lock, thus shortening the time of lockage.

References to former reports are given on page 675 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic.

Fiscal year ending June 30—	Tons.	Estimated value.	Number of passengers.
1900	17,710	....	30,639
1901	22,426	....	34,762
1902	19,710	....	52,720
1903	36,181	....	50,821
1904	31,967	....	76,971
1905	35,166	$2,286,125	64,403
1906	46,884	2,813,040	133,070
1907	53,770	3,226,200	89,239
1908	54,954	3,297,240	86,615
1909	34,168	2,050,000	70,482

July 1, 1908, balance unexpended	$1,489.75
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	735.90
July 1, 1909, balance unexpended	753.85
July 1, 1909, outstanding liabilities	60.00
July 1, 1909, balance available	693.85

Amount (estimated) required for completion of existing project	$199,260.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	105,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U U 9.)

10. Operating and care of canals and locks at the Cascades of the Columbia River, Oregon.—The canal and locks around the obstructions in the Columbia River at Cascades, Oreg., were so far completed that they were opened to navigation on November 5, 1896, since which time appropriations have been made under the general work of improvement for further completing the walls and slope pavement, grading, etc. A general description of the location, dimensions, etc., is given in the preceding report.

Since the opening of the locks more or less dredging has been required, especially at the upper entrance, where an accumulation of sand and silt made navigation difficult at the lower stages of the river. Dredging had been previously done to maintain an open channel at the upper entrance, but no attempt had been made to entirely clear the upper entrance of the material which had been deposited from year to year.

During the past year a dredging plant was fitted up, and after the high-water period dredging operations were commenced and a total of 27,347 cubic yards was removed, which practically cleared the upper entrance of all deposits.

There was expended during the fiscal year the sum of $15,953.83, which was applied to dredging, to the installation of new cable tightening gear, the purchase of a compressor plant for sand-blasting outfit, and keeping up the usual repairs to the operating machinery, grounds, and buildings.

The total amount expended from the indefinite appropriation, on account of operating, maintenance, repairs, etc., to the close of the fiscal year was $114,600.71.

The commerce through the locks during the fiscal year amounted to 34,168.02 tons, valued at approximately $2,050,000. This commerce consisted principally of wheat, flour, miscellaneous grain, cattle, horses, wool, country produce, general merchandise, etc., a detailed statement of which is given in the district officer's report.

(See Appendix U U 10.)

11. Columbia River between Vancouver, Wash., and the mouth of Willamette River.—The city of Vancouver, Wash., is on the north bank of the Columbia River, about 103 miles above its mouth, and 5 miles above the junction of the Willamette and Columbia rivers. Originally vessels drawing about 23 feet could ascend the Columbia River to within about 2½ miles of the city, where there was a bar over which there was only about 9 feet at low water. This bar resulted partly from an excess of width in the main river, and partly from a diversion of a portion of the waters to the south side of Hayden Island.

The original project, adopted by the act of July 13, 1892, provided for constructing a pile, brush, and rubblestone dike about 3,000 feet in length, from the Oregon shore to the head of Hayden Island opposite Vancouver, in order to stop the flow south of the island during low-water stages, deflect it down the main channel, and scour out the troublesome shoals. This project contemplated a depth of 20 feet or more, but this depth was not realized after the completion of the dike.

The existing project, adopted by act of March 3, 1905, is based on the report of the district officer dated July 22, 1902, approved by the Board of Engineers for Rivers and Harbors, and provided for the maintenance of a channel 20 feet deep at low water, and 150 feet wide, by dredging. The estimate was $60,000 for original work, and $10,000 yearly for maintenance of the channel and dike at the head of Hayden Island.

The total amount expended on the original and modified projects to June 30, 1909, was $143,318.60, of which the sum of $45,786.44 was applied to maintenance.

No work was in progress during the year except that of making a survey of the shoals between the railroad bridge at Vancouver and deep water below the lower end of Hayden Island. The survey was made with a view to redredging the shoals, but a suitable dredge could not be obtained for doing the work.

The completion of the dike at the head of Hayden Island, and revetting the bank to prevent erosion, caused considerable scouring on the shoals below Vancouver, but only increased the depth about 1 foot. Under the modified project for dredging, the channel was dredged in 1905 to the desired width and depth and again redredged in the fall of 1906. The survey made in September, 1908, shows that the channel had shoaled in places to 10 feet or less at low water. The variation of the water surface at Vancouver, due to tidal influence, is about eight-tenths of a foot at low water. The annual summer freshet, due to melting snow in the mountains, rises to a height of about 20 feet above low water. Steamboats drawing 8 feet can navigate the river as far as The Dalles, about 210 miles from its mouth, by passing through the locks at the Cascades.

The deep-sea tonnage is principally lumber, but during the calendar year 1908 no shipments were made from Vancouver.

The Spokane, Portland and Seattle Railway Company has completed during the year their bridge across Columbia River at Vancouver, and have trains running on their new road along the north bank of the Columbia River as far as Kennewick, Wash., making connections at that point with the Northern Pacific Railroad. The maintenance of a 20-foot channel over the shoals below Vancouver will allow of deep-sea vessels loading lumber cargoes at the Vancouver mills and save lighterage charges that would otherwise be necessary.

The amount estimated as a profitable expenditure will be applied to the maintenance of the projected depth and may be considered as an extension of benefits.

Previous reports on examinations and surveys will be found in the Annual Reports of the Chief of Engineers for 1892, page 2865; 1896, page 3264, and 1904, page 3497.

July 1, 1908, balance unexpended	$9,986.92
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
	14,986.92
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	305.52
July 1, 1909, balance unexpended	14,681.40
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix U U 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND PORTLAND, OREGON, DISTRICT.

This district was in the charge of Lieut. Col. S. W. Roessler, Corps of Engineers, division engineer, Northern Pacific division, to July 11, 1908, and of Maj. J. F. McIndoe, Corps of Engineers, since that date, having under his immediate orders Capt. Arthur Williams, Corps of Engineers, since January 11, 1909. Division engineer, Lieut. Col. John Biddle, Corps of Engineers, temporarily.

1. *Willamette River above Portland, and Yamhill River, Oregon.*—The Willamette River rises in the Cascade Range, flows northerly, and generally parallel to the coast line, and empties into the Columbia about 12 miles below Portland and 100 miles from the sea.

The Yamhill River is a tributary which has its source in the Coast Range, flows in a northeasterly direction, and enters the Willamette 40 miles above its mouth.

Prior to improvement both streams were obstructed by drift, snags, rock ledges and rapids, and gravel shoals, which prevented navigation during low-water stages. In early days the river formed the only means of transportation, and carried large quantities of grain and farm products to the Portland market, notwithstanding the difficulties of navigation.

Reference is invited to Annual Reports of the Chief of Engineers for 1876, page 654, and 1880, page 2280, for a description of the Willamette River before improvement.

The original project was adopted in 1870, the first appropriation being made by the act of March 3, 1871. This project was modified in 1878 and 1896, and provided for improvement by the removal of snags and other obstructions, and the deepening of gravel shoals by scraping and by contraction works. The modification of 1896 also provided for the construction of a lock and dam in the Yamhill River below Lafayette, at an estimated cost of $69,000.

The total amount expended on the work prior to adoption of the present project was $247,747.51.

The present revised plan or project (see Annual Report of the Chief of Engineers for 1904, p. 3529) provides for improvement below Corvallis, with a view to obtaining, mainly by dredging, auxiliary dam and revetment work, and by snagging, a low-water depth of 2½ to 3½ feet from Corvallis to Oswego, and a low-water depth of 12 feet thence to Portland. The plan allows snagging above Corvallis to Harrisburg, but above the latter point the channel is to be left as not worthy of further improvement. The estimated cost of carrying on the work was given as $213,500.

The amount expended on the existing project to the close of the fiscal year was $398,004.74, which includes $3,000 expended on the Long Tom River, and $175,384.06 for maintenance.

The work is carried on by use of government plant, consisting of a combined dredge and snag boat, one dipper dredge, and one piledriver. During the past year snagging, dredging, and revetment work was carried on from July 1, 1908, to November 30, and April, 1909, to June 30,1909, and different shoals were dredged between Corvallis and Newberg. A total of 77,579 cubic yards of material were removed from the channel, and a total of 730 snags were removed from the channel and banks between Corvallis and Newberg, and repairs were made to revetment and dikes at Wheatland, Independence, and Five Islands.

The work done on the Willamette River has greatly improved the conditions, and, with annual maintenance, will furnish a navigable channel at medium stages to Corvallis, 119 miles above Portland, and during low water to Independence, 83 miles above Portland, and to Dayton, on the Yamhill River, 8 miles above its mouth. The head of navigation on the Willamette is Harrisburg, 152 miles above Portland, but boats reach the latter point only on the higher stages.

The work done on the Yamhill River has been the completion of the lock and dam near Lafayette, about 8 miles above the mouth, under project of 1896, and clearing the channel of obstructions.

The head of navigation on the Yamhill River is McMinnville, 18 miles from the mouth, but boats seldom go above Dayton.

The forests adjacent to the Willamette Valley produce large quantities of logs, and most all of the tributaries are used for logging purposes, for distances ranging from 20 to 45 miles. An annual log drive takes place each spring on the Willamette, between the upper river points and Newberg.

The commerce consists of lumber, grain, hay, hops, potatoes, fruit, and garden truck. This commerce, including general merchandise and supplies received and logs towed, amounted, during the calendar year 1908, to 403,148 tons, valued at $8,014,164.

The falls of the Willamette at Oregon City, 12 miles above Portland, and around which a canal and lock were constructed in early days by private capital furnishes a very large water power. This water power and the locks are controlled by the Portland Railway, Light and Power Company, and a charge of 50 cents per ton is made for all traffic which passes through the locks. During the calendar year this traffic amounted to 73,578 tons, not including large quantities of logs and timber. The falls furnish power for the main generating plant of the above company, also for large woolen, lumber, and paper mills.

The lands of the Willamette Valley are very rich and productive, and the products are annually increasing. The river furnishes an easy means of transportation, and carries a large proportion of these commodities.

The Southern Pacific Railway practically parallels the river on each side, and the Oregon Electric Company is now operating an electric line between Portland and Salem.

Although the locks in the Yamhill River are little used, these locks, together with the water transportation furnished by the Willamette, are instrumental in reducing the freight rates on all shipments from valley points.

The amount estimated as a profitable expenditure is to be applied to construction of revetments, dredging, snagging, and making repairs to existing works. The work is necessary to maintain the available channel.

For previous reports on examinations and surveys, attention is invited to the Annual Reports of the Chief of Engineers as follows: Willamette River, 1892, 1893, and 1896, pages 2840, 3529, and 3309, respectively; Yamhill River, 1875, 1891, 1893, 1895, and 1904, pages 792, 3381, 3531, 3602, and 3569, respectively; canal and locks at Oregon City, 1900, 1904, and 1905, pages 4368, 3559, and 2497, respectively; opposite Salem, 1898, page 3051; opposite Albany, 1904, page 3564.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
1899	117,782		50,738
1900	182,458		47,324
1901	191,901		103,971
1902	192,227		95,221
1903	236,823		66,510
1904	332,130	$11,260,196	65,947
1905	362,258	12,119,596	67,396
1906	383,911	7,591,623	41,160
1907	412,846	8,193,746	41,998
1908	403,148	8,014,164	29,029

July 1, 1908, balance unexpended	$19,708.32
Amount allotted from appropriation by river and harbor act approved March 3, 1909	20,000.00
	39,708.32
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	21,960.57
July 1, 1909, balance unexpended	17,747.75
July 1, 1909, outstanding liabilities	2,168.00
July 1, 1909, balance available	15,579.75
Amount (estimated) required for completion of existing project	103,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	60,000.00

(See Appendix V V 1.)

2. *Operating and care of lock and dam in Yamhill River, Oregon.*—The lock and dam are situated on the Yamhill River, 8 miles above its mouth, and 10 miles below the head of navigation, at McMinnville. It was constructed under appropriation for improving Willamette and Yamhill rivers, for the purpose of affording low-water navigation to McMinnville. It was completed and opened to navigation in 1900.

During the past fiscal year the lock has been open to navigation except for 74 days during the fall and winter months, when it was closed on account of high water. The total traffic through the lock amounted to 986 tons of freight and 375 passengers. The freight consisted largely of log rafts and pulp wood, and the passengers were principally parties in small boats and launches, there being no regular line of boats operating on the Yamhill River at the present time.

Steamer traffic has been practically abandoned since 1902, and the reason given is that boats formerly operating on the Yamhill River now find more profitable business on the Willamette. It is claimed by steamboat interests that the uncertainty of lock operation during the freshet season makes it impossible to compete with railroad rates.

During the year there was expended in operating, care, and maintenance the sum of $1,188.66, and the total expended for the same purpose to the end of the fiscal year 1909 is $37,371.87.

(See Appendix V V 2.)

3. Columbia and Lower Willamette rivers below Portland, Oreg.—The portions of the rivers covered by this improvement include the 12 miles of the Willamette between Portland and its mouth, and 98 miles of the Columbia from the mouth of the Willamette to the sea. The original condition of the channel from Portland to the sea was such that only from 10 to 15 feet could be carried over shoal places at low water. Numerous sand bars obstructed navigation by deep-water craft, and on these bars the water was spread over an extended area, so that the channels through them were comparatively narrow. The value and availability of this waterway for purposes of commerce are illustrated by the fact that Portland is one of the principal grain exporting cities in the United States, the valley of the Columbia being a natural outlet for the products of Oregon, Washington, and Idaho.

Prior to the adoption of the project, dredging had been done for temporary relief, and the sum of $221,780.46 expended for that purpose. The original project was adopted in 1877, with a view to obtaining a channel depth of 20 feet. In 1891 the project was extended, with a view to obtaining a low-water channel of 25 feet, at an estimated cost of $772,464, and the Port of Portland Commission, a corporation existing under the laws of the State of Oregon, was granted permission to assist in the work. On the original and modified project, exclusive of the amounts named above, there has been expended the sum of $1,080,874.11. This does not include any part of the expenditures which have been made by the Port of Portland Commission.

The present project was adopted by the act of June 13, 1902. It is based on a survey made in 1900, which is printed in the Annual Report of the Chief of Engineers for 1900, page 4418. The project proposes a 25-foot channel, by the construction of controlling works and by dredging. The estimated cost was $2,796,300, with $175,000 as the cost of the new dredge and accessories.

The total amount expended on this project to the end of the fiscal year was $509,962.09. This amount does not include any portion of the sum expended by the Philadelphia district for dredge construction, and it may be stated that all the expenditures have been applied to maintenance. The total amount received from miscellaneous sources, account of sales, is $623.78.

The act of March 2, 1907, appropriated $300,000 for constructing and operating a dredge. This dredge was constructed on the Atlantic coast and was delivered at Portland April 21, 1909. The amount expended on her construction, including expenses of voyage from Philadelphia, Pa., was $303,543.86, and for details of the work see Appendix H 10.

The work in progress on the Columbia River during the year has consisted entirely in dredging over some of the most obstructive shoals. A total of 341,430 cubic yards of material was removed at the different shoal places in the estuary of the Columbia with the dredge *W. S. Ladd.* The Port of Portland Commission also operated its dredges in the upper reaches when funds were available and when dredging was required. The commission reports having removed a total of 2,326,568 cubic yards during the year. The new dredge *Clatsop*, constructed under the supervision of the Philadelphia (Pa.) district, arrived at Portland the latter part of April. She was overhauled and commenced dredging on June 25, and to the close of the fiscal year removed 16,504 cubic yards of material.

Thus far none of the permanent works provided for in the project have been constructed, as operations have consisted principally in dredging, and no part of the project can therefore be considered as completed. The maintenance of the channel has been of great advantage to shipping, and there has been no time during the year when a vessel could not safely load to a draft of 24 feet. The ruling depth at mean low water, from Portland to the sea, is about 22 feet, except at two places, Upper Sands and Taylor Sands, where the depths are only 21½ feet and 20 feet, respectively, but by taking advantage of the tides vessels have experienced little delay.

The head of deep-water navigation is at Portland, Oreg., on the Willamette River, 110 miles above the mouth of the Columbia. Light-draft boats ascend the Willamette for 150 miles, and by using the state portage road between Celilo and Big Eddy cargoes of light-draft boats, during high stages, reach Pittsburg Landing, a point on the Snake River 537 miles above the mouth of the Columbia. The Columbia and Willamette rivers, over this stretch, probably form the greatest waterway for logging and rafting purposes in the United States. Lumber and shingle mills are located along the banks, and logs are floated down all the tributaries from points 20 to 90 miles inland and towed to the different mills to be manufactured. During the calendar year 1908, seven rafts of logs and piling timbers, aggregating, approximately, 35,000,000 feet b. m., were made up in the Columbia River and towed to San Francisco and southern California ports.

The export commerce consists principally of grain and lumber, while the imports are composed principally of oriental products, cement, coal, lime, sulphur, etc. The light-draft tonnage is chiefly dairy, farm, and lumber products and miscellaneous machinery and mercantile supplies.

The total commerce handled during the calendar year 1908 amounted to 4,615,372 tons, valued at approximately $70,509,475.

It is not believed that the completion of the project will have any effect on freight rates until greater depths are obtained over the bar at the entrance to the Columbia River, thus allowing the use of ships of greater draft and carrying capacity.

The amount estimated as a profitable expenditure is to be applied to maintenance by dredging and making repairs to dikes and revetments. The maintenance of the channel is essential, pending the construction of permanent contraction works, the estimate for beginning these works being deferred in order that projects of special character, such as the Dalles-Celilo Canal and the purchase of the private canal in the Willamette River at Oregon City, may be provided for by adequate appropriations or by authorization of contracts.

The two channels around Swan Island, below Portland, originally divided the current of the river to the detriment of both. A shoal bar existed at the head of each channel. To remove that of the east channel, a dike was constructed across the head of the west channel. The east channel, which is used by all vessels, is very crooked at one portion, and it is sometimes difficult to avoid collision between deep-sea vessels and log tows. The latter are the main source of worry to the deep-sea navigators in the Swan Island channel. There is a general desire to have the west channel dredged out to a sufficient depth to accommodate log tows. This improvement is deemed a necessary one in view of the increasing commerce of this port. In making appropriation for the improvement of the ship channel, it is recommended that so much of the money as may be necessary be authorized for dredging out the west channel to such extent as may be necessary to accommodate log tows. A gap 300 feet wide has been left in the dike in the west channel to permit the passage of shoal-water boats.

References to former reports are given on page 683 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic.

Calendar year.	Handled by river vessels.		Handled by seagoing vessels.				Handled by river and seagoing vessels.	
	Quantity.	Estimated value.	Receipts.	Shipments.	Total.	Estimated value.	Quantity.	Estimated value.
	Tons.		*Tons.*	*Tons.*	*Tons.*		*Tons.*	
1899	1,489,708	....	36,253	336,134	372,387	....	1,862,095	....
1900	1,287,582	....	32,905	489,385	552,290	....	1,809,872	....
1901	1,534,780	....	29,548	639,736	669,284	....	2,204,064	....
1902	1,567,336	....	145,514	985,912	1,131,426	....	2,698,762	....
1903	1,596,220	....	173,006	659,178	832,184	....	2,428,404	....
1904	1,905,451	$30,775,609	229,833	548,495	778,328	$27,281,302	2,683,779	$58,056,911
1905	2,313,153	26,712,339	210,026	736,779	946,805	31,786,607	3,259,958	58,498,946
1906	2,331,121	26,377,640	226,656	974,317	1,200,973	34,407,991	3,532,094	60,785,631
1907	2,586,964	31,583,804	572,441	1,092,276	1,664,717	45,000,000	4,251,681	76,583,804
1908	2,927,041	27,509,475	586,278	1,102,053	1,688,331	43,000,000	4,615,372	70,509,475

July 1, 1908, balance unexpended		[a]$146,579.90
Amount allotted from appropriation by river and harbor act approved March 3, 1909		[b]100,000.00
Received account of sales		18.55
		246,598.45
June 30, 1909, amount expended during fiscal year:		
For dredge construction	$123,820.48	
For maintenance of improvement	42,949.71	
		166,770.19
July 1, 1909, balance unexpended		79,828.26
July 1, 1909, outstanding liabilities		[c]5,680.49
July 1, 1909, balance available		74,147.77
Amount (estimated) required for completion of existing project		2,498,509.93
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909		175,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix V V 3.)

4. *Mouth of Columbia River, Oregon and Washington.*—Prior to the commencement of the work of constructing the jetty in 1885 there were from one to three channels across the bar, and these channels varied from time to time both in location and depth. The depths were from 19 to 21 feet at low water, while the location shifted through nearly 180° between Cape Disappointment and Point Adams.

For a map of the locality and information regarding conditions before improvement, attention is invited to the Annual Report of the Chief of Engineers for 1886, page 1976 et seq.

The first project was adopted in 1884, and provided for the construction of a low-tide jetty, 4½ miles in length, extending seaward from Point Adams, on the south side of the entrance, and terminating at a point about 3 miles south of Cape Disappointment. It was to be built of rubble stone, with a foundation of brush mattresses. This project was modified in 1893 to provide for raising the jetty to high-tide level, and for building four groins from 500 to 1,000 feet in length on the north side.

The estimated cost was $3,710,000, and the jetty was completed to a length of 4½ miles in 1895, and increased the depth over the bar to 31 feet. The total amount expended on the original project was $1,968,753.14, prior to which $17,500 had been appropriated and expended for survey, etc.

The present project was formulated for the purpose of arresting the shoaling process which commenced soon after the completion of the work, the depth having decreased to about 28 feet in 1899, and the location of the channel having shifted into an unstable position 2 miles north of the 1895 channel. By 1902 the depths had deteriorated to 21 feet at low water.

---

[a] Including $94,779.82 withdrawn by Major Deakyne for dredge construction.

[b] Eighteen thousand dollars allotted to Major Deakyne for dredge construction.

[c] Includes $1,280.49 for dredge construction.

The first appropriation for a new project was made by the act of June 6, 1900, when $250,000 was appropriated for repairs, etc., pending a report to be made by a board of engineers. The report of this board, which is printed in the Annual Report of the Chief of Engineers for 1903, pages 2275 et seq., constitutes the present project, and provided for extending the jetty seaward a farther distance of about 2½ miles. Dredging was also recommended as a temporary expedient, as well as the construction of a north jetty, should it be found necessary at some future time, in order to secure the desired depth of 40 feet, with a practicable width.

The estimated cost of the south jetty was $2,260,000; of the north jetty, $1,205,000; of remodeling and operating dredge, $250,000.

The revised estimate, approved April 17, 1909, for a completion of the south jetty was $3,529,300, and is based on a report made by the district officer, recommending that the jetty enrockment be raised to at least mid-tide level, and that its crest be given a width of not less than 25 feet, in order to protect the trestle piling from early destruction by storms and teredo. The increased cost is due to the greater amount of stone required, the increase in cost of materials, and the heavy loss, during construction in previous years, due to destruction of the trestle by winter storms and teredo. In some places the jetty is being built in depths as great as 39 feet, and with 15 feet increase in the width of its crest it becomes at once evident that an enormous increase in the amount of rock is required.

The act of March 3, 1909, contained an item of $200,000 for remodeling and operating the dredge *Chinook*, which was formerly the transport *Grant*, and which has been laid up at the government moorings below Portland, Oreg., for the past four years on account of the unsafe condition of her boilers. It is proposed to install new boilers and cut down her upper work, in order to reduce her displacement and draft. The work is to be done under contract.

There has been expended on the existing project to the end of the fiscal year the sum of $4,564,249.20. The portion derived from miscellaneous sources, account of sales, amounted to $1,428.39.

The operations during the past year have consisted in extending the jetty tramway a total distance of 3,960 feet seaward, and over this distance, except the outer portion, the enrockment was brought up to a height of 5 to 8 feet above mean low tide. The enrockment over about 7,926 feet of previous years' extensions was also widened and brought up to the same general elevation. The stone received under contract and dumped on the jetty during the year amounted to 612,404 tons.

Active operations were suspended from December 31, 1908, to April 13, 1909, during which period the receipt of stone was discontinued on account of inclement weather.

At the close of the year an expert dredge designer had been assigned from the Philadelphia district to the work of preparing plans and specifications for the remodeling of the dredge *Chinook*.

The work has been carried on under continuing contract for the purchase of rock, but there is no balance remaining to be appropriated, as the act of March 4, 1909, provided $250,000, which completed all previous authorizations.

The proportion of the project accomplished to the end of the fiscal year is approximately 58 per cent, based on the revised cost.

The advantage derived from the improvement has been the increase of about 5½ feet depth on the bar since the adoption of the project. This is shown by the survey completed just at the close of the fiscal year. A copy of the map is transmitted with the district officer's report, and by referring to it it will be seen that, aside from an increase in depth in the westerly channel of about 1½ feet during the year, there is a marked tendency, due to the scouring effect, to lessen the distance between deep water on the inside and deep water on the outside of the crest, besides a reduction in the total width resulting in a well-defined channel with a least depth of 26½ feet, as against 25 feet the previous year.

The gradual movement of Peacock Spit to the north and west, and the westerly movement of Clatsop Spit, are encouraging exhibits, and indicate the controlling influence of the jetty as it advances.

The variation of the level of water surfaces, due to tides, is about 7.4 feet. The head of navigation for deep-sea vessels crossing the bar is at Portland, 110 miles above the mouth.

The commercial statistics will be found with the report in improving Columbia and Lower Willamette rivers, below Portland, Oreg. (p. 861).

Deepening of the channel over the bar will admit of the use of ships of greater draft and increased carrying capacity, and with larger vessels frequenting the port it is reasonable to suppose that the charter rates on deep-sea tonnage will be reduced, and may also reduce the present rail rates on transcontinental shipments.

The amount estimated as a profitable expenditure for improvement is for the purpose of extending the jetty seaward, with a view to increasing the depths and extending the benefits already attained. The $60,000 estimated for maintenance is for operating the dredge *Chinook*, when the work of remodeling her has been completed.

Reference to former reports will be found on pages 686–687 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1908, balance unexpended	$1,510,123 06
Amount allotted from appropriation by river and harbor act approved March 3, 1909	700,000.00
Amount appropriated by sundry civil act approved March 4, 1909	250,000.00
Received from sales	37.05
	2,460,160.11
June 30, 1909, amount expended during fiscal year, for works of improvement	1,015,810.06
July 1, 1909, balance unexpended	1,444,350.05
July 1, 1909, outstanding liabilities	151,600.00
July 1, 1909, balance available	1,292,750.05
July 1, 1909, amount covered by uncompleted contracts	306,000.00
Amount (estimated) required for completion of existing project[a]	2,013,920.00
Amount that can be profitably expended in fiscal year ending June 30 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	1,560,000.00

(See Appendix V V 4.)

---

[a] For south jetty only.

5. *Clatskanie River, Oregon.*—The Clatskanie River rises in the Coast Range and empties into the Columbia River 65 miles below Portland, Oreg. Before it reaches the Columbia it winds, for 3 miles, through marshy low lands, and by a narrow, tortuous channel. Before improvement the obstructions to navigation were a single shoal with but 2 to 3 feet of water, and two sharp bends below the town of Clatskanie.

The original and present project was adopted by the act of March 3, 1899, and provided for dredging out the shoal and cutting off the two sharp bends by means of dredging, at an estimated cost of $13,000.

There has been expended on this work, to the close of the fiscal year, the total sum of $12,675.47, of which sum $868.10 was applied to maintenance. There has been no work done during the past year, as the amount available was not sufficient to accomplish any results.

A permit was granted to the Columbia Agricultural Company, under date of January 5, 1909, to dredge across a bend near the mouth for the purpose of diking some of the low land. This work was commenced in June.

All of the work contemplated under the present project was completed in 1902, and resulted in giving a depth of 5 feet over the shoalest places, and in making the channel shorter by 4,050 feet and easier of navigation. Clatskanie, a small town 3 miles above its mouth, is the head of navigation, and at the close of the fiscal year about 3½ feet could be carried over the shoalest part of the channel.

The whole stretch of the river is tidal, with a variation of water level, due to tides only, of about 5 feet. The backwater of the Columbia, during freshet time, raises the river to a maximum height of about 10 feet.

The stream is used extensively for logging purposes, as there are fine forests of fir, hemlock, spruce, and cedar along its banks, reaching to the headwaters.

The commerce of Clatskanie River consists principally of sawmill products, farm and dairy products, and general supplies. During the calendar year 1908 this commerce amounted to 46,382 tons, valued at, approximately, $381,492.

The Astoria and Columbia River Railroad crosses the valley about 1½ miles from the town of Clatskanie, but the greater portion of the business is done by boat, because of the cheaper rates for transportation. The commerce is handled by a boat making three trips per week between the towns of Clatskanie and Portland.

Since the completion of the improvement shoaling has taken place, and the amount estimated as a profitable expenditure is for the purpose of redredging the shoals and furnishing better facilities for the increased commerce.

The total amount estimated as a profitable expenditure should be appropriated, owing to the fact that the balance remaining of the old appropriation ($324.53) has been returned to the surplus fund, as provided by section 10 of the act of March 4, 1909.

For further information regarding this improvement, attention is invited to the Annual Report of the Chief of Engineers for 1898, page 3049, and House Document No. 134, Fiftieth Congress, first session.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1899	68,126		5,210
1900	88,622		5,305
1901	51,967		2,136
1902	23,790		1,180
1903	25,765		494
1904	18,861	$444,210	525
1905	16,408	612,970	
1906	10,339	216,630	
1907	22,925	280,616	502
1908	46,382	381,492	422

July 1, 1908, balance unexpended	$324.53
Reverted to the surplus fund, as provided by section 10 of act of March 4, 1909	324.53
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	500.00

(See Appendix V V 5.)

6. *Cowlitz and Lewis rivers, Washington.*—(*a*) *Cowlitz River.*—The Cowlitz River rises in the Cascade Range, flows in a southerly direction, and empties into the Columbia 64 miles above its mouth and about 45 miles below Portland. Prior to improvement the ruling depth to Toledo, 40 miles above the mouth, was about 14 inches at low water, and the channel was crooked and obstructed by sand bars, snags, and drift.

The original and present project was adopted by the act of June 14, 1880, and provided for the removal of sand bars and other obstructions to a point about 50 miles above the mouth, at a cost of $5,000, and an annual expenditure thereafter of $2,000 for maintenance.

The expenditures to the close of the fiscal year amounted to $51,528.01, of which $46,529.01 has been applied to maintenance.

Operations during the past fiscal year consisted in clearing the channel of some troublesome snags. The work was done in April, by small boat and crew, by blasting.

The project, except as to maintenance, has been completed. The work done in previous years has resulted in furnishing a comparatively easy channel for boats running to Portland. The maximum draft that can be carried over the shoalest places at the close of the year is approximately 14 to 16 inches at low water. The usual variations of the level of water surfaces, due to tide, range from 4 feet at the mouth to zero 9 miles up the stream. The extreme variation on account of freshets is about 22 feet, except at the mouth, where the country is open, allowing the water to spread over a large area, The head of navigation for light-draft boats on the higher stages is 10 miles above Toledo, or about 50 miles from the mouth. Large quantities of logs are annually floated down the river from the headwaters, for a distance of 25 to 90 miles.

Kelso, 4½ miles from the mouth, and having a population of about 1,500 people, is the principal town of the valley, and is the center of a large lumber and shingle industry. Kelso and Castle Rock, another small town about 20 miles from the mouth, are both on the main line of the Northern Pacific Railway, and while some lumber products are shipped by rail, the farm products are usually handled by the river boats and marketed at Portland. The river is therefore a great factor in regulating freight rates from these points to competing points on the river. The traffic consists of lumber and farm products and general merchandise, of which 53,309 tons were handled during the calendar year 1908, valued at $1,934,982.

The amount estimated as a profitable expenditure is required to maintain the channel and remove the obstructions which are brought down the stream during freshet periods. Annual work is necessary to make the improvement available.

References to former reports will be found on page 689 of the Annual Report for 1905. Report of survey made in October, 1908, with estimate of cost of improvement, from the mouth to Castle Rock, is printed in House Document No. 1167, Sixtieth Congress, second session.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1899	26,511	....	....
1900	17,279	....	....
1901	14,211	....	....
1902	15,932	....	....
1903	41,515	....	....
1904	26,120	$1,069,020	6,875
1905	46,646	1,494,260	6,000
1906	56,109	2,055.460	1,117
1907	66,424	3,390,000	759
1908	53,309	1,934,982	....

This statement does not include 187,734,187 feet b. m. (375,468 tons) of logs sent down this stream in 1908, having an estimated value of $1,126,404.

July 1, 1908, balance unexpended	$1,421.67
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	299.68
July 1, 1909, balance unexpended	1,121.99
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	[a]

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*b*) *Lewis River.*—The Lewis River rises in the Cascade Range, flows in a westerly direction, and empties into the Columbia River about 14 miles below the mouth of the Willamette and 25 miles below Portland. At a distance about 3¾ miles from its mouth the river separates into two branches, known as the North Fork and the East Fork, of which the North Fork is the larger stream. The lower reaches are affected by the tides and also by back water from the

---

[a] See consolidated money statement on page 869.

Columbia. Originally the channels were obstructed by snags, overhanging trees, and occasional shoals, but were navigable for small, light-draft boats at proper stages to La Center on the East Fork and Woodland on the North Fork.

The original project was adopted in 1897 (see Annual Report of the Chief of Engineers for 1897, p. 3473). It provided for the removal of snags and obstructions, dike construction and dredging, with a view to securing a depth of 6 feet in the main river and 4 feet on the East Fork to La Center. The estimated cost was $20,460.

The present project is the same as the original one, except that the improvement of the North Fork was included in the river and harbor act of June 13, 1902, for which no estimate of cost has been made.

There has been expended on the original and modified project to the close of the fiscal year the sum of $21,114.62.

Operations during the year were confined to snagging and clearing overhanging trees from the banks. The work was done in January, and a total of 132 snags were removed from the channel and 169 trees cut from the banks. This work was done by the U.S. snagboat *Mathloma* after completion of operations on the upper Willamette River.

The work done in previous years has resulted in a good channel for boats plying between Portland and Lewis River points. The maximum draft that can be carried at normal stages to the forks is about 4 feet, and on the two forks to the head of navigation about 1 foot.

The head of navigation on the North Fork has heretofore been considered at Woodland, but at the present time a small boat is making three regular trips per week to Runyon, about 23 miles above Woodland.

The variation of the water surfaces, due to tides, is from 2 feet at the mouth to 1½ feet at La Center, while at Woodland the tide has no effect. The winter freshets vary from 15 to 20 feet in height, except near the mouth, where the water spreads out over a large area, and the conditions are such that regular boats from Portland reach La Center during about three months of each year and Woodland about nine months. Logs are floated down this stream for a distance of 20 to 45 miles above the mouth.

The Northern Pacific Railway, between Portland and Puget Sound, crosses the river at Woodland, but the river carries the greater part of the commerce from the valley, owing to the cheaper rates of transportation and the better facilities for handling traffic by water. The commerce consists principally of lumber, farm products, and general supplies, and during the calendar year 1908 amounted to 17,771 tons, valued at approximately $1,112,840. This does not include large quantities of logs floated down the stream.

The amount estimated as a profitable expenditure is required for dredging and snagging. A large amount of sediment and numerous snags are brought down by the freshets, which necessitates additional work each year to maintain the channel and make it available for boats of light draft.

References to former reports are given on page 690 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1899	6,549	....	12,351
1900	12,638	....	14,129
1901	17,277	....	15,532
1902	13,831	....	13,098
1903	29,033	....	13,058
1904	27,245	$834,492	12,885
1905	26,554	1,067,733	29,026
1906	19,024	960,120	16,614
1907	20,140	1,179,117	13,869
1908	17,771	1,112,840	13,880

This statement does not include 49,451,021 feet b. m. (98,902 tons) of logs sent down this stream in 1908, having an estimated value of $296,706.

July 1, 1908, balance unexpended	$3,290.42
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,555.04
July 1, 1909, balance unexpended	1,735.38
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	(a)

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

CONSOLIDATED.

July 1, 1908, balance unexpended	$4,712.09
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,854.72
July 1, 1909, balance unexpended	2,857.37
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	7,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix V V 6.)

7. *Grays River, Washington.*—Grays River is a tributary of the Columbia River, emptying into Grays Bay, nearly opposite the town of Astoria, Oreg. It rises in the Coast Range and flows through dense forests until it reaches the lowlands bordering on the Columbia River. It has been navigated for years with difficulty, owing principally to numerous snags and logs and overhanging trees.

The original and present project was adopted by the act of March 2, 1907, which appropriated $2,500 for the purpose of removing the obstructions from the channel and cutting the overhanging trees from the banks. The project for this work was based on a report of the Board of Engineers for Rivers and Harbors, dated October 13, 1906, by which it was proposed to carry the improvement to the head of navigation.

---

[a] See consolidated money statement on this page.

The total amount expended on this work to the close of the last fiscal year was $2,129.47.

Operations during the year were carried on from September 1 to 25, 1908, with a small snagging crew using a gasoline launch. A total of 195 troublesome snags were removed by the use of powder, of which approximately 600 pounds were used. Scraping of the bars between the mouth and the town of Grays River was also carried on by means of a hoisting engine, from May 18 to June 9, and at the close of the fiscal year there was a good, clear, and open channel to the head of navigation.

It may be stated that all of the work contemplated under the project has been completed, and has resulted in furnishing a safe and easier channel for small boats navigating the stream. The maximum draft that can be carried to Grays River, a small town 8 miles above the mouth, is about 3 feet at low water.

The variation of water surfaces, due to tides, is from 5 to 8 feet.

This stream is used extensively for logging purposes, logs being floated from the headwaters, a distance of about 10 miles.

The commerce of this stream consists principally of logs towed from the lower portion of the stream to the mills along the Columbia, and some farm products and supplies handled by a small boat plying from Astoria. Statistics, other than 938,000 feet of logs towed, are not available.

The river is the only means of transportation, and aside from furnishing easier navigation for the lightdraft boats using the channel, it is not believed the improvement will have any tendency to reduce the present rates of transportation.

The winter freshets usually bring down snags and logs, and the available balance, together with the amount estimated as a profitable expenditure, will be applied to the purpose of removing them, as may be necessary.

July 1, 1908, balance unexpended	$1,386.70
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,016.17
July 1, 1909, balance unexpended	370.53
July 1, 1909, outstanding liabilities	260.15
July 1, 1909, balance available	110.38
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	500.00

(See Appendix V V 7.)

8. *Gauging waters of Columbia River, Oregon.*—The object of this gauging is to obtain data for use in connection with the improvement of the river and to supply information to persons interested in its navigation.

The self-registering gauge was established at Astoria in November, 1888, where it was kept in operation up to August, 1899, and then moved to Fort Stevens, where it could be more economically maintained. A river gauge was also established at the mouth of the Willamette River and daily records of the readings kept. In view of the benefit to commerce, the maintenance of these gauges is considered a worthy object.

The amount expended on this work, principally for gauge readers, up to June 30, 1909, was $8,649.94.

July 1, 1908, balance unexpended	$1,470.06
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	120.00
July 1, 1909, balance unexpended	1,350.06
July 1, 1909, outstanding liabilities	10.00
July 1, 1909, balance available	1,340.06
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	1,000.00

(See Appendix V V 8.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated January 11, 1908, and October 8, 1908, on preliminary examination and survey, respectively, of *Cowlitz River, Washington, up to Castlerock*, required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 1167, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $22,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SEATTLE, WASHINGTON, DISTRICT.

This district was in the charge of Lieut. Col. H. M. Chittenden, Corps of Engineers, to September 5, 1908, and of Maj. C. W. Kutz, Corps of Engineers, since that date, having under his immediate orders First Lieut. J. H. Earle since February 1, 1909. Division engineers, Lieut. Col. S. W. Roessler, Corps of Engineers, to July 11, 1908, and Lieut. Col. John Biddle, Corps of Engineers, temporarily, since that date.

1. Willapa River and Harbor, Washington.—Willapa Harbor connects with the Pacific Ocean in the extreme southwestern part of the State of Washington. Willapa River flows into the bay at its eastern extremity, about 10 miles from the sea entrance to the harbor.

South Bend, near the mouth of the river, the terminus of a branch line of the Northern Pacific, and Raymond, about 3 miles above South Bend, are the principal towns in that locality. Willapa is a small town 10 miles above South Bend. North River is a stream flowing into the bay from the north, and Nasel River is an arm making off from the southeast part of the bay proper.

Originally shoals existed in the river below Willapa, and there was a log jam in North River.

The original project adopted by act of July 13, 1892, contemplated dredging 100 feet wide to a depth of 8 feet at low water through the reef just below Willapa and the closing of side sloughs near South Bend by means of dikes, with the object of increasing channel depths by scour. This project was modified by act of March 2, 1907, which provided for dredging a channel 150 feet wide and 12 feet deep at mean lower low water through the shoals between South Bend and Raymond at an estimated cost of $25,000.

Under acts of August 18, 1894, and March 3, 1899, removal of the log jam in North River was authorized.

The amount expended on original and existing project to close of fiscal year ending June 30, 1909, was $61,008.70, of which $4,210.26 was applied to the maintenance of dikes and for inspection of obstructions to navigation.

The dredging work authorized by act of March 2, 1907, was commenced November 15, 1907, and completed February 29, 1908. The work was done by contract.

The expenditures during the past fiscal year were in connection with the establishment of harbor lines and for inspections.

The appropriation recommended will be applied to maintenance of existing channels and dikes.

The best channel depth at mean lower low water is now about 16 feet to South Bend, 12 feet to Raymond, and about 6 feet to Willapa.

The extreme variation of water levels is 14 feet, and the mean variation is 9 feet.

The North and Nasel rivers are navigable only for small boats of light draft for a comparatively short distance above their mouths, and this distance is extremely variable with the tides. The principal business on these rivers is the rafting and floating of logs. The log and lumber business on Willapa Bay and tributary streams is by far the most important part of the water traffic.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	32,399	$374,050	1904	73,808	$389,377
1899	51,150	755,682	1905	76,713	456,213
1900	42,090	266,080	1906	116,717	1,220,434
1901	39,538	229,686	1907	183,801	1,847,810
1902	51,999	402,050	1908	214,812	2,347,253
1903	74,475	446,800			

The direct effect on freight rates of the work done is not known definitely.

Reference to reports, etc., may be found in the Annual Report of the Chief of Engineers for 1907, page 781.

July 1, 1908, balance unexpended	$511.86
Received from sales	1.00
	512.86
June 30, 1909, amount expended during fiscal year, for works of improvement	170.06
July 1, 1909, balance unexpended	342.80
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix W W 1.)

2. *Grays Harbor and bar entrance, Washington.*—Grays Harbor is a large bay in the southwestern part of the State of Washington connecting with the Pacific Ocean. It has a total length from east to west of 17 miles, and its greatest breadth north and south is 14 miles.

A large part of the bay is occupied by tide flats, bare at low water. At low tide the area covered by water is estimated at 30.6 square miles, or less than one-third of the total area.

A short distance within the harbor entrance are large areas affording anchorage for deep-draft vessels.

The harbor entrance is between two low sandy peninsulas, which are about 12,500 feet apart, measured between high-tide lines.

Through this entrance there is a channel having a maximum depth of 100 feet or more. A single broad waterway extends for more than 2 miles out to sea from the entrance, with depths gradually diminishing to 30 feet. At the outer end of this deep waterway lies a bar convex to the sea and extending each way to the sand spits on the two sides of the harbor throat.

Across the bar there was originally no good permanent channel, but there were several variable, shifting channels having depths of about 12 or 13 feet. The general average width of the bar between the inner and outer 18-foot curves was one-half mile.

The original project, adopted by Congress June 3, 1896, provided for the control of tidal currents by means of a single jetty extending out to sea from the point on the south side of the harbor throat a distance of about 3½ miles, with a view to improving and maintaining the channel over the bar by scour. The jetty was to be of rubblestone, built above high-tide level. This project contemplated a depth of 24 feet at mean low water.

The estimated cost was $1,000,000. The act making the first appropriation for this work authorized the making of a continuing contract or contracts. In accordance with this authority a contract for the entire work was entered into after due advertisement. Work under this contract was commenced in March, 1898, and terminated September 15, 1902. The jetty was constructed for a distance of 13,734 feet from the ocean high-water line. No construction work on the south jetty has been done since.

The project was enlarged by the river and harbor act of March 2, 1907, which provided for the construction of a jetty on the north side of the harbor throat, extending out to sea about 9,000 feet from the ocean high-water line, at an estimated cost of $600,000. The act appropriated $200,000 and authorized continuing contracts for completing the project in the additional sum of $400,000, which amount has been appropriated.

The amount expended to June 30, 1909, was $1,343,075.28, of which $7,235.72 was for maintenance and surveys.

The work on the north jetty has been in progress since October 1, 1907. The necessary land for approach and operating plant was donated to the United States by local interests. The trestle approach to the jetty and the wharf and other features of the shore works were built under contract, the work commencing on October 24, 1907, and being completed March 31, 1908. A contract has been made for the stone for the jetty, the other material being furnished under emergency contracts or purchase in open market.

During the fiscal year 7,376 linear feet of trestle were constructed, and at the close of the fiscal year the trestle had been built to its projected length, 10,000 feet from the ocean high-water line. The mattress foundation was placed the entire length of the trestle and 67,467 tons of stone were placed during the year. The enrockment for a distance of about 5,000 feet from the high-water line is 6½ feet above the plane of mean lower low water, and for the outer 5,000 feet of the jetty the enrockment varies from 6½ feet above to 10 feet below that plane.

A survey of the bar was made during May, 1909, and the controlling depth was found to be 19 feet at mean lower low water.

The original project for the improvement of the entrance to Grays Harbor contemplated securing and maintaining a depth of 24 feet at mean lower low water. The modified and existing project was adopted to assist in securing the depth contemplated by the original project and to correct serious deterioration of the channel, which had occurred. The funds appropriated for the construction of the north jetty will be sufficient to complete it to the extent contemplated by the modified project, but to secure the proposed depth of 24 feet it will probably be necessary to extend the north jetty approximately 4,000 feet and raise the enrockment to the plane of high water.

Reference is made to the report of a Board of Engineers published in House Document No. 576, Fifty-eighth Congress, second session.

The work of maintenance consisted only in care of the property.

The maximum draft that could be carried June 30, 1909, at mean lower low water over the shoalest part of the channel was 19 feet.

The extreme variation of water levels in the outer portion of the harbor is 16.5 feet, while the mean variation is 8.4 feet.

So far as known the improvement has not caused any reduction in freight rates.

The commerce benefited by the work consists at present principally of exportation of lumber, carried in sail and steam vessels. This is a large and important business.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	168,468	$1,252,089	1904	495,495	$4,200,784
1899	265,918	1,979,998	1905	579,759	5,552,166
1900	259,692	2,077,037	1906	614,854	7,735,954
1901	299,607	1,877,800	1907	747,725	8,862,687
1902	527,047	3,601,163	1908	827,154	7,421,311
1903	458,268	4,073,333			

July 1, 1908, balance unexpended	$430,921.61
Amount appropriated by sundry civil act approved March 4, 1909	100,000.00
Received from sales	3.75
	530,925.36
June 30, 1909, amount expended during fiscal year, for works of improvement	243,993.29
July 1, 1909, balance unexpended	286,932.07
July 1, 1909, outstanding liabilities	3,293.56
July 1, 1909, balance available	283,638.51
July 1, 1909, amount covered by uncompleted contracts	266,303.73

(See Appendix W W 2.)

3. Grays Harbor (inner portion) between Aberdeen and the entrance to said harbor, and Chehalis River, Washington.—There are two main channels traversing the inner or eastern part of Grays Harbor from east to west—the North and South channels. There was also formerly a Middle channel connecting the North and South channels. The South channel is shoal and is but little used. The North channel is used by all ocean-going vessels entering the harbor. There are two shoals in the North channel, one about 2½ miles below Hoquiam and one between Hoquiam and Aberdeen. The ruling depth over these shoals was originally 8 feet at mean low water. The channel widths were ample.

The Chehalis River is in the southwestern part of Washington. It has a westerly course and empties into Grays Harbor Bay at its eastern extremity.

From the mouth to Montesano, 15 miles, there is about 10 feet of water at high tide. From Montesano to Elma, 16 miles, there is generally sufficient water for light-draft boats. There is practically no navigation above Elma and no regular boats go above Montesano. The river is used extensively for floating saw logs.

The original project for the inner harbor, adopted by Congress July 13, 1892, provided for the construction of piles, brush, and stone dikes to partly close up the South and Middle channels and concentrate the flow of water in the North channel, thereby increasing the depth of water by scour. The shoals above and below Hoquiam were to be dredged to a depth of 16 feet at half tide.

The amount expended prior to operations under existing project was $93,999.06.

The original project for Chehalis River, adopted by Congress August 2, 1882, contemplated the removal of snags and other obstructions which may accumulate in the portion of the river regularly used by boats. The estimated cost is indefinite.

The existing project adopted by the river and harbor act of March 2, 1907, provides for a channel 200 feet wide and 18 feet deep at mean lower low water from Cosmopolis to deep water below Hoquiam, and removing snags from the Chehalis River, at an estimated cost of $187,500. This plan is printed in House Document No. 507, Fifty-ninth Congress, first session.

Report on examination and survey of the Chehalis River, made in compliance with the river and harbor act of March 2, 1907, was published in House Document No. 1125, Sixtieth Congress, second session.

To June 30, 1909, $252,864.77 had been expended under the above project for Grays Harbor, inner portion, of which $20,440.38 was applied to maintenance of dikes and for surveys.

Two middle dikes and a protecting sill, with an aggregate length of 13,986 feet, had been constructed in the inner harbor, and six high-tide dikes, with an aggregate length of 1,476 feet, had been constructed in the Chehalis River. The depth of water over the shoals in the inner harbor was increased about 2 feet and over the shoals in the Chehalis River from 2½ to 7 feet, but these depths were not permanent.

The dredging work under the existing project was done by contract. It was commenced December 16, 1907, and the total quantity of material removed was 1,200,000 cubic yards. The quantity removed during the fiscal year was 300,000 cubic yards. The contract was completed on August 24, 1908.

The project was partially completed with the funds available, but the channel secured is not of the full width contemplated by the act of March 2, 1907. It is expected to obtain the full project width by operating the new dredge *Oregon* with funds provided by the river and harbor act approved March 3, 1909.

The maximum draft that could be carried June 30, 1909, over the shoals below Aberdeen at mean lower low water was about 18 feet.

The maximum draft that could be carried June 30, 1907, at mean low water at Montesano was about 5½ feet.

The tidal variation is 8½ feet in the inner harbor and 7 feet in the Chehalis River.

The commerce benefited by this improvement consists very largely of floating and towing logs and carrying lumber in sailing vessels and steam schooners.

The appropriation recommended will be applied to maintenance of existing works.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	2,730	$293,610	1904	5,637	$248,825
1899	2,232	352,316	1905	17,195	650,428
1900	4,376	132,157	1906	11,567	773,574
1901	5,706	200,264	1907	9,414	687,703
1902	3,529	157,532	1908	38,004	595,718
1903	4,972	139,150			

No definite information of reduction of freight rates on account of the improvement has been received.

Reference to reports, projects, etc., may be found on page 785 of the Annual Report of the Chief of Engineers for 1907.

July 1, 1908, balance unexpended	$92,404.73
Amount allotted from appropriation by river and harbor act approved March 3, 1909	25,000.00
Received from sales	27.00
	117,431.73
June 30, 1909, amount expended during fiscal year, for works of improvement	88,268.56
July 1, 1909, balance unexpended	29,163.17
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	16,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix W W 3.)

4. Puget sound and its tributary waters, Washington.—Most of the channels of Puget Sound proper have ample depths for purposes of navigation, but the extensive lumber and fishing industries in these waters render it very important to maintain a general supervision over the navigable channels, to regulate the construction of fish traps, log booms, and other structures incident to these important industries, and to prevent obstructions which are detrimental to general navigation. A number of streams and rivers tributary to

Puget Sound are of great value to boat navigation, but they are all liable to be obstructed by the débris generally found in streams flowing through a heavily wooded country.

All these streams are used to a greater or less extent for floating logs and shingle bolts, and the towing of log rafts and timber products constitutes the main part of the commerce. The distance upstream to which boats run is extremely variable, depending on the stage of water and tide. Steamboat navigation on the Skagit extends as far up as the mouth of the Sauk, but boats do not often ascend above Hamilton or Birdsview. No survey has been authorized by Congress above Sedro Woolley, 25 miles above the mouth of the river. On the Stilaguamish boats do not go above Florence, 6 miles from the mouth. The Snohomish is navigable for river boats to the Forks, 22 miles, and the lower portion of one of its tributaries, the Skykomish, is navigable at high stages. The Snoqualmie River is navigable at a low-water stage for a distance of 30 miles from the Forks, and at high stages for an additional distance of 20 miles. On the Duwamish small boats go as far the junction of the White and Black rivers, about 16 miles from the mouth. Under favorable conditions they can go several miles up the White, and occasionally boats pass up the Black into Lake Washington. On all these streams the distances to which steamboat navigation actually extends are generally less, and the distances over which towing and floating of logs extend are greater than the distances above named. None of these streams is closed in winter by ice. All are affected by the tidal variation in Puget Sound, which is large and extremely irregular.

The work of improvement consists in the maintenance of the navigable channels by snagging and removing obstructions.

Formerly works of improvement were carried on under specific appropriations, but since the act of June 13, 1902, appropriations have been made in the present general and comprehensive form, except in cases of large local works. This method operates greatly to the advantage and economy of the work.

The amount expended to June 30, 1909, was, $337,387.60.

The act of March 2, 1907, provided for the removal of the rock in the entrance to Roche Harbor at a cost not to exceed $30,000. The work was begun October 1, 1907, under contract, and completed April 17, 1908.

The water traffic on Puget Sound and its tributary waters is very large and rapidly growing. It includes vessels of about every type and size in use throughout the world, but it is quite impracticable to give in the form of concise statistics a condensed statement of the amount and value of the commerce more or less directly benefited by work under this appropriation. Statistics have been compiled only for the tributary streams on which the snag boat has mostly worked.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	12,676	$539,406	1904	92,465	$1,790,823
1899	13,500	577,586	1905	86,412	1,817,048
1900	35,066	1,324,926	1906	167,197	1,898,057
1901	30,155	1,499,420	1907	124,336	3,011,146
1902	61,794	2,324,980	1908	44,922	1,659,930
1903	94,274	3,193,458			

No definite information relative to effect of the work on freight rates is available, but the increasing number of vessels engaged indicates greater competition.

Reports of examinations and surveys of the rivers of Puget Sound are referred to in Annual Report of the Chief of Engineers for 1904, page 692.

Reports on examinations and surveys of the Skagit and Snohomish rivers under the river and harbor act of March 2, 1907, were published in House Documents Nos. 1188 and 1108, Sixtieth Congress, second session.

Reference to reports on the examination and survey of the Duwamish River authorized by the river and harbor act of March 3, 1905, will be found on page 787 of the Annual Report of the Chief of Engineers for 1906.

During the past year the snag boat operated extensively in all parts of the Sound, doing a large amount of work.

The snag boat is no longer capable of serving the needs of the district. It was built in 1882, the hull renewed in 1896, and it is now in a condition that practically requires another renewal. It is not sufficiently seaworthy to be safe in ordinary rough weather in the Sound. A new plant is required, and it is proposed to provide a combined snag boat and small suction dredge to do such work as is not of sufficient magnitude to be undertaken by contract.

There is a considerable amount of miscellaneous work in the district that is paid from this appropriation, such as investigation of harbor lines, bridges, obstructions, occasional surveys, gauge readings, etc.

The snag boat was in commission three hundred and thirty-five days during the year and laid up undergoing repairs for a period of thirty days.

The following table shows the work accomplished on the streams tributary to Puget Sound:

Name of river.	Time.	Number of snags removed.	Length.	Number of trees cut.	Length.
	Days.		*Feet.*		*Feet.*
Skagit	151	1,774	28,119	149	14,020
Snohomish	90	1,257	21,122	224	12,835
Snoqualmie	67	1,494	22,289	248	13,200
Stilaguamish	19	207	2,596		
Swinomish Slough	8	5	156		
Total	335	4,737	74,282	621	40,055

The Snoqualmie River was cleared of snags and made navigable for small vessels for a distance of 30 miles. One gasoline vessel now makes daily trips over that portion of the river, which it was impossible to do prior to the removal of obstructions by the snag boat.

July 1, 1908, balance unexpended	$23,937.30
Amount allotted from appropriations by river and harbor act approved March 3, 1909	25,000.00
Miscellaneous receipts	126.35
	49,063.65
June 30, 1909, amount expended during fiscal year, for works of improvement	21,161.75
July 1, 1909, balance unexpended	27,901.90
July 1, 1909, outstanding liabilities	5,202.02
July 1, 1909, balance available	22,699.88
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909	120,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899	

(See Appendix W W 4.)

5. Inspection of fish traps, etc., Puget Sound, Washington.—The fishing industry on Puget Sound has rapidly developed during the past few years, and it has now reached very large proportions. Until four years ago the fish traps were placed with little or no regard to the established aids to navigation or to the laws relative to structures in navigable waters, but during the year 1904 the fishing companies were brought to the adoption of a different policy. Since 1904 this work has been done under allotments from the appropriation for "Examinations, surveys, and contingencies of rivers and harbors." Under these allotments a tug was hired for the inspection of fish traps from time to time as necessary. A tug was so engaged for two months during the year.

As a general rule all the fish-trap owners and fishing companies now readily conform to the requirements that have been imposed for the safety of navigation, and the federal supervision of the traps in the interest of navigation is recognized locally as most necessary and beneficial to the public interests.

The total amount expended to June 30, 1909, was $31,470.89, of which $3,346.47 was expended during the year.

Form of permit and rules relative to lights and fog signals were published in the Annual Report of the Chief of Engineers for 1905, pages 2558–2560.

To carry out more effectively and economically the inspection of fish traps and other obstructions to navigation an inspection boat has been constructed for exclusive use in this work. The boat is 63 feet long, 11 feet 6 inches breadth of beam, and has a draft of 4 feet, and is propelled by a 50-horsepower gasoline engine.

(See Appendix W W 5.)

6. Harbor of Olympia, Wash.—Olympia is situated at the extreme southern point of Puget Sound at the head of Budd Inlet. The upper end of this inlet is shoal. Shoal water extends northward from the Fourth Street Bridge for a distance of 8,750 feet to a depth of 12 feet at mean lower low water in Budd Inlet. Originally nothing but shallow-draft boats could reach the wharves near Fourth Street Bridge, and those only at high tide.

The original and existing project, adopted by Congress by act of July 13, 1892, contemplates dredging a channel 250 feet wide and 12 feet deep at the mean of the lower low waters from the vicinity of the Fourth Street Bridge to deep water in Budd Inlet.

Near its inner end the channel has been widened to 500 feet, so as to provide a turning basin for boats using it. The estimated cost is $147,000.

The amount expended to June 30, 1909, was $139,946.09, of which $1,066.86 was for maintenance. The expenditures during the past year were for inspections and the preparation of commercial statistics.

The dredging of the channel and basin was completed in accordance with the project under contract. The maximum draft that could be carried through the channel and basin on June 30, 1907, at low water was 12 feet. The maximum tidal variation is about 20 feet.

The commerce of the harbor is of general character and is carried on by ocean-going sailing vessels engaged in the lumber trade and by a variety of the smaller classes of boats plying between the ports of Puget Sound. Sufficient depth for seagoing vessels has not yet been secured in the dredged channel and basin, though vessels of the deepest draft can go as far as the entrance of the dredged channel, and sailing vessels carrying lumber now reach wharves near the entrance to the dredged channel at high tide and lie in a dredged basin while loading.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	52,335	$1,203,226	1904	20,152	$356,450
1899	42,694	1,173,684	1905	62,804	2,069,289
1900	35,466	848,703	1906	82,024	2,363,433
1901	44,559	951,435	1907	95,171	2,846,955
1902[a]	....	....	1908	51,140	2,737,708
1903	40,333	341,635			

[a] Not obtainable.

No definite information as to the effect on freight rates of the work done is available.

Description and map are published in Annual Report of the Chief of Engineers for 1900, pages 4481 to 4483.

Reports on examination and survey of Olympia Harbor are referred to in Annual Report of the Chief of Engineers for 1904, page 694.

Reference to reports on examination and survey authorized by the river and harbor act of March 3, 1905, will be found on page 787 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1908, balance unexpended	$7,119.47
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	65.56
July 1, 1909, balance unexpended	7,053.91

(See Appendix W W 6.)

7. *Tacoma Harbor, Washington.*—At the southern end of the harbor are extensive tide flats, which are bare at low water. Outside of these tide flats the depth increases very rapidly up to depths of 200

feet or more, reaching depths as great as 600 feet at the mouth of the bay, about 3 miles distant from the low water line at its southern end. The principal water front of Tacoma is along the southwestern shore of the bay. Harbor lines have been established around the south end of the bay and along its western side. In order to facilitate commerce several waterways extending into the flats or tide lands have been laid out. One of these is known as the City, or West, waterway. The harbor of Tacoma may be considered to embrace all of Commencement Bay, including the waterways mentioned.

The extreme tidal variation is some 18 feet; mean variation, 14.5 feet.

The original and existing project for improvement of the City waterway, adopted by Congress by the act of June 13, 1902, contemplates dredging in the City waterway from deep water in Commencement Bay to Eleventh street to a depth of 25 feet, from Eleventh street to Fourteenth street to a depth of 18 feet, and from Fourteenth street to the south end of waterway to a depth of 15 feet at extreme low water. The dredging was done under a continuing contract.

The amount expended to June 30, 1909, was $203,421.49, of which $12,322.71 was for maintenance, inspections, and surveys.

The City waterway has been completed according to the project, and the prescribed depths could therefore be carried for the whole length and width of the waterway on June 30, 1906.

The act of March 3, 1905, provided for improvement of the Puyallup waterway by dredging a channel 500 feet in width and 3,650 feet in length from its northern end and to a depth of 28 feet at extreme low water, in accordance with the report submitted in House Document No. 520, Fifty-eighth Congress, second session, at an estimated cost of $240,000. The same act appropriated $40,000 and authorized continuing contracts for completing the project in the sum of $200,000, which has been appropriated. The act requires that certain portions of the necessary work shall be done without expense to the United States, and that provision for permanent maintenance of the project without expense to the Government shall be made.

The conditions named in the said act have been complied with, and a contract was let for the work October 3, 1907, and is now in progress.

The commerce to be benefited by this improvement is of a large and extremely varied character, including that carried on by sound and river types of boats, as well as that of the largest steam and sailing vessels. A very important item is the export of grain, in which the port of Tacoma exceeds all other ports on Puget Sound.

Report on examination and survey of Puyallup River under the river and harbor act of March 2, 1907, was published in House Document No. 1107, Sixtieth Congress, second session.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1903	1,715,085	$58,153,845	1906	1,120,070	$48,253,383
1904	1,561,074	53,726,772	1907	1,570,396	54,163,018
1905	1,844,338	65,613,183	1908	1,183,296	44,694,148

No definite information is available as to the effect of the improvement on freight rates.

Work was begun under the contract December 26, 1907.

During the year 855,000 cubic yards of material were excavated and placed behind the bulkheads. The bulkhead work was about 75 per cent completed at the end of the year. About one-third of the waterway has been dredged to full dimensions.

July 1, 1908, balance unexpended		$210,072.09
Amount appropriated by sundry civil act approved March 4, 1909		40,000.00
		250,072.09
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$37,586.24	
For maintenance of improvement	907.34	
		38,493.58
July 1, 1909, balance unexpended		211,578.51
July 1, 1909, outstanding liabilities		197.97
July 1, 1909, balance available		211,380.54
July 1, 1909, amount covered by uncompleted contracts		161,400.00

(See Appendix W W 7.)

8. *Waterway connecting Puget Sound with Lakes Union and Washington, Washington.*—Lakes Union and Washington are bodies of fresh water near Puget Sound, in the immediate vicinity of the city of Seattle. Lake Union is entirely within the city limits. The proposed improvement originally contemplated a ship canal connecting both lakes with the sound. There is no navigable connection at present.

A succinct history of the project and references to reports, etc., may be found on pages 791 to 793 of the Annual Report of the Chief of Engineers for 1907.

The only actual work done on the proposed waterway has consisted of dredging a channel from the sound to the wharves at Ballard, in Salmon Bay, and the excavation of a cut between Lake Union and Salmon Bay, for the control of the water level in Lake Union. The work was done under the river and harbor acts of June 3, 1896, and March 3, 1905. It has resulted in a channel 50 feet wide and 16 feet deep at low water from Puget Sound to a point 2,000 feet west of the lock site. From this point to the lock site the channel is 75 feet wide and 16 feet deep. From the lock site to the railroad trestles at the eastern part of Ballard Harbor the channel is 75 feet wide and 10 feet deep at low water. A turning basin ranging from 175 feet to 500 feet in width has been dredged at Ballard.

The amount expended to June 30, 1909, was $470,072.77. Of this amount $22,992.93 was expended in maintenance and on improvement of drainage of Lake Washington. The expenditures during the past year were for operating outlet gates and general care of the right of way.

The present commerce benefited by the improvement of the channel to Ballard is the towing of logs to the mills at Ballard and the export of lumber and shingles from that place. Logs are brought in in rafts and lumber is loaded on sailing vessels and scows at the mills and then towed to the open sound.

It has not been practicable to determine what effect the improvement work has had upon freight rates.

The maximum draft that could be carried to the wharves at Ballard, June 30, 1909, at extreme low water, was 10 feet. The maximum tidal variation is about 18 feet.

Early in 1906 a movement was started for the construction of the canal with local funds and to this end secured the passage of an act of Congress, approved June 11, 1906, authorizing James A. Moore or his assigns to construct a canal along the government right of way connecting the waters of Puget Sound with Lake Washington. This act was modified by the act of March 2, 1907, so as to permit Mr. Moore or his assigns to commute the work required under the previous act to excavation alone of a canal from deep water in Puget Sound to deep water in Lake Washington, with a bottom width of 75 feet and a depth at mean low water of 25 feet. The same act directed a survey and estimate of cost of a canal with a single lock and a report as to what contribution, if any, local interests would make toward its construction.

To assist the United States through the agency of the Moore acts in building a canal, the county of King voted a bond issue of $500,000 on September 12, 1906. These bonds were declared invalid by the supreme court of the State. An attempt was made by the legislature to remedy the defect, but its efforts were not upheld by the supreme court.

On March 13, 1907, the State legislature passed an act creating a local assessment district, embracing territory that would be benefited by the canal, and empowering the district to raise by taxation a sum not exceeding 1 per cent of the taxable valuation of the county, and to use the money so received to aid in constructing the canal. The board of appraisement was appointed by the local United States district judge, and the money is to be expended under the direction of the United States engineer officer in charge of the local engineer district. Under this act the district was duly formed by the necessary action of the county commissioners, the board of appraisement was appointed, and the work of making the assessment is completed. The assessment has to be considered by the county commissioners sitting as a board of equalization, after which it is subject to collection, either in cash or in issue of bonds. The board of county commissioners declined to act as a board of equalization and proceedings were begun in the superior court to compel the commissioners to act. The lower court rendered a decision against the contention of the county commissioners and the case will be carried to the supreme court of the State. The sum to be raised under the assessment act is $1,075,000, which is intended to yield, after the cost of assessment and collection and other incidental expenses are paid, the sum of $1,000,000 in aid of the canal.

On March 17, 1909, the State legislature passed an act creating the state shore land improvement fund and appropriated out of said fund the sum of $250,000 to be expended in the construction of the Lake Washington Canal, under the direction of the United States engineer officer in charge of the local engineer district.

The total local contribution now in view is, therefore, $1,250,000.

A report on survey required by the river and harbor act of March 2, 1907, was published in House Document No. 953, Sixtieth Congress, first session.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1901	410,565	$2,002,950	1905	888,161	$4,588,198
1902	428,073	2,432,401	1906	705,841	3,993,410
1903	524,500	2,219,000	1907	797,228	5,520,518
1904	584,079	2,520,785	1908	530,352	3,098,954

NOTE.—The above includes only the present commerce of Ballard and Salmon Bay, Lake Union, and Lake Washington.

The loading of vessels with lumber has been largely facilitated by the work done in Ballard Harbor. Formerly the lumber was taken out by means of lighters to the vessels anchored in the Sound. Now all but the largest vessels are brought to the mills to receive their loads.

The appropriation recommended will be applied to maintenance of existing channels and care of outlet gates at Lakes Washington and Union.

July 1, 1908, balance unexpended	$1,033.73
Amount allotted from appropriation by river and harbor act approved March 3, 1909	5,000.00
Received from sales	.50
	6,034.23
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	1,106.50
July 1, 1909, balance unexpended	4,927.73
July 1, 1909, outstanding liabilities	67.00
July 1, 1909, balance available	4,860.73
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix W W 8.)

9. *Everett Harbor, Washington.*—At this harbor the southern part of the water front has ample depth and is accessible for vessels of the deepest draft. The northern portion was inaccessible on account of the delta formation or tide flats off the mouth of the Snohomish River and the whole water front was exposed to westerly storms.

The original project was as follows:

First, to excavate a harbor basin in the shallows and tide lands adjoining deep water near the river's mouth; second, to dredge a channel from this through the tide flats and the Old River mouth to deep fresh water in the Snohomish River, this channel being designed to bring fresh water to the harbor basin and to afford facilities for navigation about the peninsula on the east; and, third, to protect and maintain this harbor and channel across the tide flats by a bulkhead interposed between them and the open waters of the Sound, the bulkhead to act as a retaining wall for the material dredged from the harbor.

By authority of joint resolution of Congress approved April 23, 1902, the work in Old River was discontinued, the project for a fresh-water basin was abandoned, and the further expenditure of the funds has been for deepening and widening the harbor basin and channel through the tide flats and repairing the bulkheads.

The estimated cost of the improvements was $422,000, all of which has been appropriated.

The amount expended on project to June 30, 1909, was $417,577.77, of which $2,867.73 was for maintenance and $3,000.90 for purchase of quarry at Goat Island.

A dike for the purpose of retaining the dredged material has been built from the lower end of Smith's Island along the established bulkhead line for a distance of 19,336 feet. At the southern end of this work an outside bulkhead 200 feet from the other has been built for a distance of 2,600 feet. These dikes have been repaired, raised, and strengthened. The channel leading north from the basin had been dredged to a depth of 6 feet at low water for a distance of 6,000 feet. A channel in the Old River had been partly dredged for a distance of 11,600 feet downstream before this part of the work was discontinued under the resolution of Congress above referred to.

The harbor basin has been dredged for a length of 5,500 feet and for a width of 400 feet and depth of 26 feet at mean low water.

No work was in progress during the year.

The maximum draft that could be carried through the dredged area June 30, 1906, at low water was 26 feet. The tidal variation is approximately 15 feet.

The water traffic is varied in character and is carried on by seagoing vessels and the various types of sound and river boats. Lumber products, paper, and flour are the principal items of the export trade.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	55,460	$2,545,054	1904	163,347	$3,342,215
1899	42,713	1,477,120	1905	230,089	4,592,124
1900	55,094	1,820,561	1906	159,203	3,820,860
1901	71,881	2,712,260	1907	143,710	4,725,700
1902	85,263	4,024,584	1908	167,667	7,116,547
1903	79,394	2,510,417			

The effect of the completed dike as a breakwater and protection for the wharves and mills abreast of it has been very beneficial, but the channel and harbor basin dredged have not yet been utilized for commercial purposes.

So far as known, the improvement has not caused any reduction in freight rates.

Reference to reports, etc., may be found on page 795 of the Annual Report of the Chief of Engineers for 1907.

July 1, 1908, balance unexpended	$4,422.23
June 30, 1909, amount carried to the surplus fund of the Treasury	4,422.23

(See Appendix W W 9.)

10. Swinomish Slough, Washington.—This slough affords an inland sheltered passage for small vessels from Puget Sound proper northward to Bellingham Bay and the Gulf of Georgia, and it is the only means of communication to the town of La Conner, located on the slough. At the northern end the slough opens out through the mud flats of Padilla Bay and on the south into Saratoga Passage through the mud flats, forming the delta of the Skagit River. The total distance from deep water in Saratoga Passage to deep water in Padilla Bay is about 11 miles. This waterway is of great importance to traffic between Puget Sound and points north in giving an inside passage for small craft in rough weather, and an outlet for the agricultural and timber products from the surrounding country.

The original and present project, adopted by Congress by act of July 13, 1892, contemplates dredging a channel 4 feet deep in Saratoga Passage across Skagit flats, through the shoals of the slough proper, and across the flats of Padilla Bay to deep water, and building dikes in Skagit Bay to control the tidal currents.

The entire work done under this project was not entirely successful, owing to insufficient knowledge of the conditions and the character of the work required to meet them. The work of the last few years has been of a more substantial character.

The amount expended to June 30, 1909, was $204,967.32, of which $31,233.45 was for maintenance.

The dike work completed to date between La Conner and Saratoga Passage is as follows: Pile, brush, and stone dike on the north side of the channel from "Hole in the Wall" to opposite the west end of Goat Island, 7,100 linear feet; on the south side of the channel from the west end of Goat Island to deep water in Saratoga Passage, 3,650 linear feet; and from McGlinns Island to the mainland in the direction of La Conner, 3,500 feet.

Dike work was completed on July 24, 1908, as far as available funds would permit.

The work accomplished has not had any effect on freight rates.

The appropriation recommended will be applied to maintenance of existing channels and dikes.

A report on examination and survey of Swinomish Slough, upon which the plan of improvement is based, is referred to in Annual Report of the Chief of Engineers for 1904, page 699.

A map showing parts of the improvement is published in the Annual Report of the Chief of Engineers for 1900, opposite page 4488.

The average tidal variation is about 8 feet.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	19,625	$882,345	1904	56,262	$1,539,094
1899	76,636	2,028,454	1905	48,724	1,363,729
1900	74,516	1,611,460	1906	53,261	1,494,382
1901	136,747	2,991,330	1907	46,289	1,582,666
1902	49,914	1,472,847	1908[a]	....	....
1903	51,399	1,473,197			

[a] Not obtainable.

July 1, 1908, balance unexpended	$1,387.85
Amount allotted from appropriation by river and harbor act approved March 3, 1909	10,000.00
	11,387.85
June 30, 1909, amount expended during fiscal year, for works of improvement	1,355.17
July 1, 1909, balance unexpended	10,032.68
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix W W 10.)

11. New Whatcom (Bellingham) Harbor, Washington.—The local name of the town at this place is now Bellingham.

The mud flats in the harbor extend from the shore line to the 12-foot curve, a distance of 3,400 feet.

A system of harbor lines for this harbor, approved by the Secretary of War under date of June 3, 1892, provides for three waterways leading from deep water to the meander line.

The original and existing project, adopted by Congress by the act of June 13, 1902, contemplates dredging the Whatcom Creek waterway to a depth of 12 feet at mean lower low water and 200 feet wide from deep water as far as the railroad bridge, and to its full width inside this bridge. The estimated cost is $80,000.

The amount expended to June 30, 1909, was $57,673.98, of which $1,092.05 was for maintenance and inspections.

A channel 200 feet wide and 12 feet deep at low water, with turning basin at inner end, has been dredged under contract. The channel extends the full length of the waterway, and the basin at the inner end has full width of the waterway, 330 feet, and is 2,570 feet long.

During the year no work has been in progress.

The work contemplated by the project was completed at somewhat less than the estimated cost, and a larger amount of dredging was done than was expected with the funds available.

The maximum draft that could be carried June 30, 1909, at mean lower low water over the full length of channel and turning basin was 12 feet. The range of tide is about 12 feet.

Exports and imports.

Calendar year.	Tons.	Value.
1902	87,118	$2,872,789
1903	101,989	1,835,486
1904	236,669	4,225,480
1905	254,240	4,690,936
1906	292,592	5,643,504
1907	319,613	7,209,796
1908	133,355	[a] 1,762,295

[a] Incomplete returns only obtainable.

The work has not yet produced any material effect on freight rates so far as known.

The commerce of this port is of a general nature, consisting largely of lumber, shingles, and fish. Vessels of the deepest draft can go as far as the entrance of the proposed dredged channel.

Description of proposed work is published in the Annual Report of the Chief of Engineers for 1897, pages 3478 to 3481.

Reports on examination and survey are referred to in the Annual Report of the Chief of Engineers for 1904, page 701.

Report on examination and survey of Bellingham Bay, authorized by the river and harbor act of March 2, 1907, was published in House Document No. 1161, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$2,326.02
July 1, 1909, balance unexpended	2,326.02

(See Appendix W W 11.)

12. Columbia River between Wenatchee and Bridgeport, Wash.—The Columbia River between Wenatchee and Bridgeport, Wash., is about 80 miles in length, has sufficient depth for all purposes of navigation, and the only difficulties in the way of navigation are the swift currents and rocks and reefs which occupy the channels.

The project adopted by the river and harbor act approved August 18, 1894, for the improvement of the Columbia River between the head of Rock Island Rapids and the foot of Foster Creek Rapids included the part of the river between Wenatchee and Bridgeport, and the amount expended on the original project was $8,005.20.

The existing project, adopted by act of March 2, 1907, contemplates the improvement of the river between Wenatchee and Bridgeport by the removal of rocks, bowlders, etc., and the construction of dikes and wing dams, at an estimated cost of $42,000.

Owing to the great range of the river between high and low water and the short period at which it is at a stage low enough for practicable operations, it was not possible to take up more than one of the several works embraced in the project.

During the past year Chelan rock was drilled but not blasted. The volume of rock to be removed is about 2,000 cubic yards and the blasting will be done at the next low-water period.

The amount expended to June 30, 1909, was $32,288.37, of which $150 was for maintenance and inspections.

The project is about 60 per cent completed.

The variation in water surface is about 20 feet.

The estimates originally submitted for this work were inadequate. At Methow Rapids the cost exceeded the estimate by nearly $15,000, and at Chelan the cost, when completed, will be about $9,000 in excess of the estimate.

To carry out the original project an additional appropriation of $25,000 will be required.

So far as known this improvement has not caused any reduction in freight rates.

Exports and imports.

Calendar year.	Tons.	Value.
1904	24,506	$2,251,590
1905	39,827	3,169,060
1906	53,260	3,901,360
1907	42,126	3,091,550
1908	54,527	3,368,119

Report of a survey including this part of the Columbia River was published in Annual Report of the Chief of Engineers for 1895, pages 3534–3542.

Report on examination and survey of the part of the river between Wenatchee and Bridgeport was published in House Document No. 440, Fifty-ninth Congress, second session, and report on examination and survey of the part of the river between Bridgeport and Kettle Falls was published in House Document No. 16, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$19,930.69
June 30, 1909, amount expended during fiscal year, for works of improvement	10,219.06
July 1, 1909, balance unexpended	9,711.63
July 1, 1909, outstanding liabilities	383.50
July 1, 1909, balance available	9,328.13
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	25,000.00

(See Appendix W W 12.)

13. Okanogan and Pend Oreille rivers, Washington.—(*a*) *Okanogan River.*—This river rises in Canadian territory, flows in a southerly direction, and empties into the Columbia. The lower portion, for a distance of 87 miles, lies in the northeastern part of Washington. The lower portion has sufficient depth and width for light-draft steamboat navigation for about four months each year, April to July, inclusive, but it is obstructed in places by shoals and rocks, which interfere with navigation during low water.

The original and existing project, adopted by Congress by act of March 3, 1899, contemplates rock removal, the construction of wing dams, and snagging. By act of June 13, 1902, this work and that of the Pend Oreille were consolidated.

The estimated cost was $30,000 for the Okanogan. The amount expended to June 30, 1909, was $38,044.25, of which $6,079.91 was for maintenance.

Work of removing rocks and bowlders, wing-dam construction, and placing posts to assist vessels in hauling over rapids has been done at various points over about 40 miles of the lower portion of the river.

Cables to assist vessels in passing the rapids were placed at seven places on the Okanogan River.

During the year no work was done on the Okanogan River, the expenditures being in connection with inspection of the river and of bridges crossing it.

The extreme variation of water levels at the junction with the Columbia is 37 feet; extreme variation 6 miles above said junction, 20 feet.

The commerce of the river is carried on in small river steamers and consists of general traffic.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1899	1,733	$151,415	1904	1,636	$252,414
1900	([a])	([a])	1905	1,184	228,675
1901	983	....	1906	1,960	253,880
1902	1,571	119,065	1907	2,040	400,100
1903	6,317	458,705	1908	1,104	210,040

[a] Not obtainable.

The freight rates on this river are believed to have been materially reduced since the work started, but no definite information is available.

Report on survey with description of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1898, page 3121.

Report on examination of Okanogan River is published in Annual Report of the Chief of Engineers for 1895, page 3475.

No additional work other than that of maintenance is contemplated on this stream.

July 1, 1908, balance unexpended	$1,981.79
June 30, 1909, amount expended during fiscal year, for maintenance of improvement	31.46
July 1, 1909, balance unexpended	1,950.33
July 1, 1909, outstanding liabilities	3.98
July 1, 1909, balance available	1,946.35

(*b*) *Pend Oreille River.*—This river forms the outlet of Pend Oreille Lake, in the northern part of Idaho.

The obstructions to navigation consist of rocks and shoals in Box Canyon and in the section between this canyon and Albany Falls.

The original and existing project, adopted by Congress by act of March 3, 1899, contemplates the improvement of Box Canyon by the removal of submerged rocks, the blowing off of projecting rocky points, and the removal of submerged rocks between Box Canyon and Albany Falls. The estimated cost was $30,000.

A modified project, approved March 29, 1907, provides for dredging to a depth of 6 feet at low water through the bars in the Pend Oreille River between Newport and Box Canyon.

The amount expended to June 30, 1909, was $28,034.33, of which $1,546.16 was for maintenance and inspections.

Channels 75 feet wide and 6 feet deep at low water were dredged through the upper and lower bars at Boundary Island. The quantity of material removed was 6,938.6 cubic yards. Work was suspended on April 28, 1909, on account of high stage of river.

Navigation through Box Canyon is possible except at high stage of water, but the danger in going down through the canyon and the expense of lining up are so great that river boats do not use it.

The river is navigable throughout the year from Newport down to Box Canyon, a distance of 54 miles, except occasional interruption from ice. A channel depth of about 3 feet can be depended on.

The extreme variation of water levels in the main river is from 17 to 20 feet; in Box Canyon the difference between extreme high and extreme low water is 48 feet.

The commerce consists of towing logs and general traffic carried on by a number of small vessels. Heavy freight is carried mainly on barges in tow.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1899	2,617	$129,677	1904	39,974	$358,453
1900	1,921	97,125	1905	54,733	462,814
1901	13,917	134,280	1906	32,943	501,834
1902	15,868	500,200	1907	2,227	152,500
1903	27,100	753,000	1908	21,724	123,000

No effect on freight rates directly attributable to the improvement has been reported.

Descriptions of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1898, page 3124.

Report of survey of the river is referred to in the Annual Report of the Chief of Engineers for 1904, page 702.

The river and harbor act of March 2, 1907, appropriated $20,000 for work on this river and the Okanogan. It is proposed to apply this sum on the Pend Oreille River in dredging through the clay bars between Newport and Box Canyon.

July 1, 1908, balance unexpended	$20,077.22
June 30, 1909, amount expended during fiscal year, for works of improvement	5,606.13
July 1, 1909, balance unexpended	14,471.09
July 1, 1909, amount covered by uncompleted contracts	12,877.63

CONSOLIDATED.

July 1, 1908, balance unexpended		$22,059.01
June 30, 1909, amount expended during fiscal year:		
For works of improvement	$5,606.13	
For maintenance of improvement	31.46	
		5,637.59
July 1, 1909, balance unexpended		16,421.42
July 1, 1909, outstanding liabilities		3.98
July 1, 1909, balance available		16,417.44
July 1, 1909, amount covered by uncompleted contracts		12,877.63

(See Appendix W W 13.)

14. St. Michael Canal, Alaska.—The St. Michael Canal is a channel running from St. Michael Bay to a point on Norton Sound about 38 miles from the Apoon mouth of the Yukon River.

The port of St. Michael is about 3 miles from the mouth of the canal.

The main part of the canal has sufficient water for the navigation of river boats plying on the Yukon River. The eastern entrance to the canal is, however, obstructed by shoals, and in the eastern portion there are several sharp bends that could be turned with difficulty by the larger river boats.

The object of the improvement of the canal is to provide a sheltered passage to river boats between St. Michael and the mouth of the Yukon River.

The original and existing project contemplates dredging in the South Branch a channel 100 feet wide to a depth of 6 feet at mean low water at the entrance to the canal and the excavation of a cut of the same dimensions across the first bends. The estimated cost was $248,000. The project was adopted by the act of March 2, 1907, and the full amount of the estimate has been appropriated.

To June 30, 1909, there has been expended on the existing project $62,047.55.

The work is being done under a continuing contract and was begun July 5, 1908, and continued until October 5, 1908, when it was suspended for the season.

A channel 3,400 feet long, 100 feet wide, and 6 feet deep was excavated, and 37,297.8 cubic yards of material removed.

The original estimate for this work was based on a unit price for dredging of 50 cents per cubic yard, while the lowest bid received was $1.45 per cubic yard.

To carry out the original project would require an additional appropriation of nearly double the amount heretofore appropriated.

The district officer in his report recommends the modified project for the work not now under contract, which will reduce the cost about $275,000, but action on this modified project has been delayed pending a personal investigation by the district officer.

The additional funds asked for will be required for the prosecution of the work during the season of 1910.

The maximum draft that can at present be carried at low water is 3 feet. The mean range of tide is 3½ feet.

Statement of freight between St. Michael and mouth of Yukon River.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1897	5,270	$512,650	1903	20,000	$1,652,891
1898	22,117	2,132,580	1904	17,356	1,316,237
1899	17,295	1,704,525	1905	25,855	2,220,830
1900	19,153	1,950,950	1906	31,999	2,799,187
1901	18,153	1,844,651	1907	29,793	2,493,697
1902	16,008	1,630,950	1908	23,785	2,090,400

It is not expected that this improvement will have any effect on freight rates.

July 1, 1908, balance unexpended	$245,241.43
June 30, 1909, amount expended during fiscal year, for works of improvement	59,288.98
July 1, 1909, balance unexpended	185,952.45
July 1, 1909, outstanding liabilities	621.33
July 1, 1909, balance available	185,331.12

July 1, 1909, amount covered by uncompleted contracts	$176,826.38
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W W 14.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination and survey of Puyallup River, Washington, with a view to straightening channel and securing suitable depth to the city of Puyallup.*—Reports dated April 26, 1907, April 4, 1908, and August 31, 1908, respectively, are printed in House Document No. 1107, Sixtieth Congress, second session. The locality is not considered worthy of improvement by the General Government in the manner proposed.

2. *Preliminary examination and survey of Snohomish River, Washington, from its mouth to Lowell.*—Reports dated April 19, 1907, and March 31, 1908, respectively, are printed in House Document No. 1108, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $280,000 is presented.

3. *Survey of Chehalis River, Washington, up to Montesano, by the removal of bars.*—Report dated March 31, 1908, is printed in House Document No. 1125, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $50,000 is presented.

4. *Preliminary examination and survey of Bellingham Harbor, Washington.*—Reports dated April 27, 1907, and March 26, 1908, respectively, are printed in House Document No. 1161, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $92,250 is presented.

5. *Preliminary examination and survey of Skagit River, Washington, up to Sedro Woolley.*—Reports dated April 15, 1907, March 31, 1908, and November 3, 1908, respectively, are printed in House Document No. 1188, Sixtieth Congress, second session. A plan for improvement at an estimated cost of $100,000 is presented.

RIVER AND HARBOR IMPROVEMENTS IN THE DISTRICT OF HAWAII.

This district was in the charge of Capt. C. W. Otwell, Corps of Engineers, to November 12, 1908, and of Maj. E. E. Winslow, Corps of Engineers, since that date. Division engineer, Lieut. Col. John Biddle, Corps of Engineers.

1. *Pearl Harbor, Hawaii.*—For history and project, see page 3433 of the Annual Report of the Chief of Engineers for 1901. No work was done during this year. The expenditures were for telegrams and

rubber stamp. There is no commerce yet in this harbor; no further funds are required.

July 1, 1908, balance unexpended	$452.66
June 30, 1909, amount expended during the fiscal year, for maintenance of improvement	29.60
June 30, 1909, amount carried to the surplus fund	423.06

(See Appendix X X 1.)

2. Honolulu Harbor, Hawaii.—This harbor is situated on the south coast of the island of Oahu. The entrance channel, through a coral reef, and the harbor proper, were dredged from time to time by the monarchical, republican, and territorial governments of Hawaii prior to July 1, 1904. On this date there existed an entrance channel having a minimum width of about 200 feet and a depth of about 35 feet at mean low water. The harbor proper had a general width of 900 feet. The water for about 200 feet immediately along the wharves had a depth of from 30 to 32 feet. Elsewhere there was only about 27 feet at low water. The bend at the light-house point was so sharp as to make it somewhat difficult for large vessels to make the turn.

Work on the present project was begun under an appropriation by the river and harbor act of March 3, 1905, in accordance with a general plan printed in the Annual Report of the Chief of Engineers for 1905, page 2564, but the project as specifically adopted by the river and harbor act of March 2, 1907, is printed in House Document No. 332, Fifty-ninth Congress, second session. It provides for an entrance channel 400 feet wide and 35 feet deep at mean low water from deep water at the entrance to the light-house point, for easing the curve at the junction of the entrance channel and the inner harbor by cutting off the light-house point, and for enlarging the harbor proper so that it will have a general width of 1,200 feet and a depth of 35 feet at mean low water, at an estimated cost of $1,628,894.60.

Between March 3, 1905, and May 27, 1908, $800,000 have been appropriated for work under the approved project, or about 49 per cent of the estimated cost of work under that project.

Work under the above appropriations was stopped by practical exhaustion of funds, on December 15, 1908. The following has been accomplished:

Dredging entrance channel, removing light-house point, and the partial widening of the harbor proper. All this dredging was to a depth of 35 feet at mean lower low water, a total of 1,910,023 cubic yards having been excavated. The completion of the adopted project is urgently required by commercial interests.

On June 30, 1909, the sum of $794,838.79 had been expended, no part of which was for maintenance.

From July 1, 1908, to the cessation of work on December 15, 1908, 208,106 cubic yards of material were removed from the harbor and deposited on shore. A careful survey was later made of the condition of the harbor. This survey showed shoaling to have taken place at the following points: A general shoaling throughout the entrance channel; a noticeable shoaling in the Nuuanu slip at the head of the harbor; a slight shoaling in front of the wharves of the naval station; and very slight shoaling in a few other localities.

The maintenance of this harbor was provided for by the act of March 3, 1909, in accordance with estimate of the Chief of Engineers, which was printed in House Document No. 1462, Sixtieth Congress, second session.

The approved project is about 49 per cent completed. On June 30, 1909, there was a minimum depth in the entrance channel of about 33 feet; within the harbor proper there was, outside of harbor lines, a general depth of 35 feet. The normal tidal oscillation is about 2 feet. The head of navigation is the head of the harbor, about 2 miles from the Light-House Department buoys marking the entrance to the harbor.

The commerce between this port and ports not in the Hawaiian Islands, for the calendar year 1908, amounted to approximately 600,000 tons, valued at $41,562,840. The commerce with other ports of the Hawaiian Islands amounted to 320,158 tons, valued at about $22,000,000.

What effect the improvement of the harbor has had upon freight rates can not be stated, but vessels are now able to enter and leave the harbor with their full load draft.

Should additional appropriations be made for this harbor, it is proposed to expend the funds in widening the harbor in pursuance with the approved project, so as to make it possible for vessels to enter and leave at all hours of the day and night, instead of by daylight only, as at present.

July 1, 1908, balance unexpended	$368,396.35
June 30, 1909, amount expended during fiscal year, for works of improvement	363,227.14
July 1, 1909, balance unexpended	[a] 5,169.21
July 1, 1909, outstanding liabilities	.50
July 1, 1909, balance available	[a] 5,168.71
Amount (estimated) required for completion of existing project	828,894.60
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement and for maintenance, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	500,000.00

(See Appendix X X 2.)

3. *Reclamation of Quarantine Island, Honolulu, Hawaii.*—For history and project, see page 853 of the Annual Report of the Chief of Engineers for 1908. No work was done during this year. The expenditures were in payment of outstanding liabilities.

At the close of the fiscal year the sum of $20,000 had been expended, exhausting the appropriation. No part of this expenditure was for maintenance.

For commercial statistics, see report for Improving Honolulu Harbor, Hawaii.

July 1, 1908, balance unexpended	$2.75
June 30, 1909, amount expended during fiscal year, for works of improvement	2.75

(See Appendix X X 3.)

4. *Harbor at Hilo, Hawaii.*—Hilo Bay is practically a deep open roadstead, protected to a limited extent by Blonde reef, but otherwise exposed through the angle formed by lines drawn from Hilo town to Kanaha and Keokea points—that is, from about north to

---

[a] In addition to this balance the sum of $25,000 is made available by the river and harbor act of March 3, 1909, but not yet allotted.

north 74° east (magnetic). Strong northeasterly trade winds prevail most of the time. These winds cause a choppy sea outside of Hilo Bay and considerable swell in the bay, which at times makes it unsafe for ships to lie at the existing wharves and renders loading and unloading in the bay difficult. The heaviest seas, however, come from the north during northerly and northwesterly storms, and during this weather it is often impossible for ships to lie at the wharves or even work in the bay.

The present project, adopted by Congress March 2, 1907, consists in constructing a rubble mound breakwater along Blonde reef to a point on shore about 6,000 feet east of Cocoanut Island, at an estimated cost of $1,700,000, as stated in House Document No. 407, Fifty-ninth Congress, second session.

As authorized in the act of March 2, 1907, the project as originally stated in the above-mentioned House document has been modified in a manner recommended on page 16 of the House document by the elimination of the third, or shore, arm of the breakwater and the extension of the middle arm of the breakwater to the shore.

For map, see page 2316 of the Annual Report of the Chief of Engineers for 1908.

Between March 2, 1907, and March 4, 1909, $400,000 has been appropriated for work under the approved project, or about 23 per cent of the estimated cost of the work under that project. Under a continuing contract the actual construction of the breakwater was commenced on September 12, 1908, and on June 30, 1909, a total of 31,507 tons of stone had been placed, making a total of 766 feet of completed breakwater.

On June 30, 1909, the sum of $71,000.86 had been expended, all on the present project, and no part being for maintenance.

The approved project is about 4 per cent completed.

The commerce of this port for the calendar year 1908 was valued at more than $16,000,000, and amounted to more than 184,000 tons.

Work on this improvement has not been carried far enough to have any effect on freight rates.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year 1911 to continuing the work of constructing the breakwater. The additional work proposed is necessary to make the improvement available.

July 1, 1908, balance unexpended	$298,274.87
Amount appropriated by sundry civil act approved March 4, 1909	100,000.00
	398,274.87
June 30, 1909, amount expended during fiscal year, for works of improvement	69,275.73
July 1, 1909, balance unexpended	328,999.14
July 1, 1909, outstanding liabilities	573.00
July 1, 1909, balance available	328,426.14
July 1, 1909, amount covered by uncompleted contracts	301,355.44
Amount (estimated) required for completion of existing project	1,300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	600,000.00

(See Appendix X X 4.)

RIVER AND HARBOR IMPROVEMENT IN THE DISTRICT OF PORTO RICO.

This district was in the charge of Maj. Charles L. Potter, Corps of Engineers. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

Harbor at San Juan, Porto Rico.—This harbor has a large area, but, prior to work under the existing project, a small portion had sufficient depth for modern shipping. With the exception of a small area in the bend around La Puntilla, which had a depth of 30 feet, the available depths varied from 20 to 30 feet. All of these depths are referred to mean low water. The usual range between high and low water is about 1 foot. The existing project adopted by the river and harbor act of March 2, 1907, is to dredge an entrance channel 600 feet wide from deep water outside to a point opposite Morro Point; 500 feet wide from there to La Puntilla, both to be 30 feet deep, and both to be widened where they make the turn around these points; and to dredge, east of La Puntilla, harbor areas amounting to 398,600 square yards to a depth of 30 feet and 70,200 square yards to a depth of 24 feet, all in accordance with House Document No. 914, Fifty-ninth Congress, first session.

The estimated cost of this improvement is $757,500, of which the act of March 2, 1907, appropriated $157,500, and authorized continuing contracts for prosecuting the project in the sum of $600,000. Of this amount the sundry civil acts of May 27, 1908, and March 4, 1909, appropriated $220,000 and $300,000, respectively, leaving $80,000 to be appropriated.

The amount expended on the existing project up to June 30, 1909, is $315,636.54 for improvement.

Work has been carried on under continuing contract at a cost of 19 cents per cubic yard (scow measurement) for soft material, and $6.80 per cubic yard (place measurement) for coral rock, and under supplemental contract, entered into February 6, 1909, whereby the contractor was granted permission to dump in a remote portion of the harbor, at a reduction in price of 5 cents per cubic yard for soft material and 30 cents per cubic yard for coral rock, when weather conditions were such as to render it unsafe for the scows to be towed to sea.

There have been removed during the last fiscal year 1,025,322 cubic yards of soft material and 8,048 cubic yards of coral rock. Of these amounts 209,259 cubic yards of soft material were dumped under the supplemental contract at a saving in cost of $10,462.95.

The result of the work has been to practically complete the areas authorized east of La Puntilla (inner harbor); to nearly complete the widening of the entrance channel at La Puntilla—only a small portion next to the point, consisting largely of coral rock, remains; and to commence work on the inner end of the entrance channel. The contractor has also done a large amount of the necessary drilling on one coral-rock shoal at the outer end of the entrance channel. This work gives much relief in the harbor proper and around the difficult turn at La Puntilla, but the draft that can be carried into the harbor is still limited to 27 feet in the entrance channel which is now being dredged. This depth will accommodate any commercial vessel entering San Juan Harbor, but they need more width, which the project will amply provide.

No work was done by the United States prior to this project, but some dredging was done by the Spanish Government.

The amount estimated that can be profitably expended for works of improvement during the fiscal year ending June 30, 1911, will be expended in continuing dredging under the contract, which work is necessary to make the improvement available. In the eighteen months between the completion of the inner harbor and final completion of the contract there will undoubtedly be some fill, especially around La Puntilla. When the contractor removes his plant, there will be nothing left nearer than the United States or Cuba that can handle such work, and any fill which may occur meantime should be removed before the plant gets away; hence the $20,000 for maintenance.

Commercial statistics, as given in the appendix, were furnished by the custom officials in San Juan, and are given in money value only.

July 1, 1908, balance unexpended		$303,341.25
Amount appropriated by sundry civil act approved March 4, 1909		300,000.00
		603,341.25
June 30, 1909, amount expended during fiscal year, for works of improvement		241,477.79
July 1, 1909, balance unexpended		361,863.46
July 1, 1909, outstanding liabilities		48,000.00
July 1, 1909, balance available		313,863.46
July 1, 1909, amount covered by uncompleted contracts		313,863.46
Amount (estimated) required for completion of existing project		80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909:		
For works of improvement	$80,000.00	
For maintenance of improvement	20,000.00	
		100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix Y Y.)

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

Section 3 of the river and harbor act of June 13, 1902, provided for the organization, in the Office of the Chief of Engineers, by detail from time to time from the Corps of Engineers, of a Board of five engineer officers, whose duties shall be fixed by the Chief of Engineers, and to whom shall be referred for consideration and recommendation, in addition to any other duties assigned, so far as in the opinion of the Chief of Engineers may be necessary, all reports upon examinations and surveys provided for by Congress, and all projects or changes in projects for works of river and harbor improvement theretofore or thereafter provided for. It is further the duty of the Board, upon request to the Chief of Engineers, by the Committee on Commerce of the Senate, or the Committee on Rivers and Harbors of the House of Representatives, in the same manner to examine and report through the Chief of Engineers upon any projects heretofore adopted by the Government or upon which appropriations have been made, and to report upon the desirability of continuing the same or upon any modifications thereof which may be deemed desirable. This provision of the law was extended by act of March 3, 1905, to require the

Board, upon request of the committees of Congress specified above, to examine and review surveys as well as projects provided for by acts or resolutions prior to the river and harbor act of June 13, 1902, and it was further modified by the act of March 2, 1907, to include consideration of any examination or survey made pursuant to any act or resolution of Congress.

Section 13 of the act of March 3, 1909, increased the scope of preliminary examinations and surveys by providing that every report therein ordered shall contain such data as it may be practicable to secure regarding (first) the establishment of terminal and transfer facilities, (second) the development and utilization of water power for industrial and commercial purposes, and (third) such other subjects as may be properly connected with such project. It further provided that the investigation and study of these questions may, upon review by the Board, "when called for as now provided by law, be extended to any work of improvement now under way and to any locality the examination and survey of which has heretofore been, or may hereafter be, authorized by Congress." Section 6 of the same act requires the Board to pass upon all modifications in plan and location involved in the reconstruction of any lock, canal, canalized river, or other work for the use and benefit of navigation, for which expenditures are authorized by that section.

During the past fiscal year the Board was composed of the following officers of the Corps of Engineers: Col. D. W. Lockwood; Col. John G. D. Knight, from October 21, 1908; Col. R. L. Hoxie, to July 14, 1908; Col. Smith S. Leach, from July 9 to September 16, 1908, and from March 31, 1909; Lieut. Col. W. C. Langfitt, from September 16, 1908; Maj. H. C. Newcomer, from December 21, 1908, to March 31, 1909; Maj. E. Eveleth Winslow, to October 21, 1908; Maj. Spencer Cosby, from July 14 to December 21, 1908; and Maj. William J. Barden.

Under the provisions of the acts of March 2, 1907, and March 3, 1909, all reports submitted in compliance with those acts have been referred to the Board for consideration and recommendation; in addition, a number of subjects have been presented to it for report in accordance with resolutions of the Committee on Rivers and Harbors of the House of Representatives, and the Committee on Commerce of the Senate. The reports rendered by the Board from time to time in response to legislative action have been duly presented to Congress. During the year the Board also gave consideration to a number of other matters referred to it by the Chief of Engineers, U. S. Army, for its views and recommendations.

Details of the operations of the Board during the past fiscal year will be found in Appendix Z Z.

SEAGOING HYDRAULIC DREDGES.

There are now 24 seagoing hydraulic dredges owned and operated by the United States, and the following statement has been prepared, showing in tabular form certain data in regard to each dredge and the work accomplished by it during the past year. In estimating the cost per cubic yard of material removed no allowance was made for a proportionate share of office expenses or for depreciation, but includes cost of all repairs and field supervision.

Performances of United States seagoing dredges for the fiscal year ending June 30, 1909.

Name	*Gedney.*	*Charleston.*	*Chinook.*	*W. S. Ladd.*	*Cape Fear.*	*Gen. C. B. Comstock.*
When built	1887	1891	1892	1893	1895	1895.
Where built	Wilmington, Del.	Brooklyn, N. Y.	Belfast, Ireland	Portland, Oreg.	Philadelphia, Pa.	Perth Amboy, N. J.
Hull material	Wood	Wood	Steel	Wood	Wood	Wood.
Length	156 feet 6 inches	122 feet 6 inches	445 feet	143 feet 6 inches	131 feet 3 inches	177 feet.
Beam	36 feet 6 inches	30 feet	49 feet	38 feet 4 inches	29 feet	35 feet 6 inches.
Depth	15 feet 6 inches	12 feet	30 feet	12 feet	17 feet	16 feet.
Displacement ... tons	751	517	5,590	750	220	764.
Speed, light ... knots	7.7	7.2		7	8	9.5.
Speed, loaded ... do	6	6		4	5	7.
Speed, dredging ... do	1.5	1.5		0.5	2	1.
Number and size of pumps	Two 15-inch	One 15-inch	Two 20-inch	Two 15-inch	Two 10-inch	Two 15-inch.
Number of men in crew	21	20		20	16	42.
Location of dredging	Main ship channel, New York Harbor.	Mobile, outer bar, Ala.	Columbia River, Portland, Oreg.	Harbor bars, Portland, Oreg.	Cape Fear River, N. C.	Galveston Harbor, Tex.
Character of dredged material	Sticky mud, sand	Sand and mud		Sand	Sand and mud	Sand, clay, shell, and silt.
Average depth of dredging	27 to 30 feet	26½ feet		21 feet	20 feet	27.84 feet.
Average load in bins ... cubic yards	572	272		400	292	646.
Material pumped per hour ... do	319	346		467	237	457.
Average number of cubic yards dredged daily	950	2,200		2,130	1,586	6,420.
Total number of loads	121	549		852	1,575	2,883.
Total amount dredged ... cubic yards	69,241	149,309		341,430	460,519	1,860,620.
Average distance to dump ... miles	9	¾		1	4	1½.
Total number of days on which any dredging was done.	73	68		160	290	290.
Total number of hours pumping	217	432		730	1,937	4,073.
Time to pump one load	1 hour 48 minutes	47 minutes		51½ minutes	1 hour 7½ minutes	1 hour 25 minutes.
Total number of hours dumping	69	50		100	191	223.
Time to dump one load	34 minutes	5½ minutes		7 minutes	7 minutes	4½ minutes.
Total number of hours going to and from dump.	218	102		303	1,149	1,000.
Total number of hours going to and from wharf.	189	214		171	250	141.
Total number of hours taking coal and water.	80	6		105	103	142.
Total number of hours lost on account of weather.	270	301		76	25	358.
Total amount of coal consumed .. long tons	754	739		1,055	1,996	23,604 barrels.
Number of pounds of coal consumed per cubic yard of material dredged.	24.4	11.1		6.9	9.7	0.53 gallons.
Cost per cubic yard, including all repairs	$0.224	$0.1813		$0.0653	$0.0519	$0.0389.
Remarks	Worked 5 months; transferred to Newport, R. I.; being repaired.	Laid up 6 months, lack of funds; repairs.	Now out of commission.	Out of commission; worked 9 months.		Uses oil for fuel.

Name	*Winyah Bay.*	*Benyaurd.*	*Sabine.*	*Cumberland.*	*Gen'l Gillespie.*	*Manhattan.*
When built	1898	1900	1901	1902	1904	1904.
Where built	Wilmington, Del	Richmond, Va	New York, N. Y	Belfast, Me	Sparrows Point, Md.	Sparrows Point, Md.
Hull material	Wood	Steel	Wood	Wood	Steel	Steel.
Length	141 feet	271 feet 6 inches	145 feet	200 feet	177 feet	288 feet.
Beam	31 feet	47 feet	35 feet	40 feet 8 inches	38 feet	47 feet 6 inches.
Depth	13 feet 6 inches	23 feet	8 feet	20 feet	19 feet	25 feet.
Displacement ... tons	466	2,006	600	1,451	1,200	3,200.
Speed, light ... knots	9	10	8.33	9.2	8.5	10.
Speed, loaded ... do	7	8	7.4	7.2	7.0	8.
Speed, dredging ... do	1 to 2	½	3.33	1 to 2	1.5	½ to 4.
Number and size of pumps	One 15-inch	Two 20-inch	Two 10-inch	Two 18-inch	Two 15-inch	Two 20-inch.
Number of men in crew	20	49	17	34	35	55.
Location of dredging	Winyah Bay, S. C., and Charleston Harbor, S. C.	Passes of the Mississippi River, La.	Sabine Pass, Tex	Savannah Harbor, Ga.	Harbors Lake Michigan.	Ambrose Channel, New York Harbor.
Character of dredged material	Soft mud, sand, and coral rock.	Sand, mud, and silt.	Soft blue mud	Sand, mud, clay, and gravel.	Sand and shell	Sand, gravel, and mud.
Average depth of dredging	13 to 22 feet	32 feet	24 feet	23 feet	20 feet	15 to 35 feet.
Average load in bins ... cubic yards	276	1,865	195	891	561	2,065.
Material pumped per hour ... do	289	588	459	670	516	862.
Average number cubic yards dredged daily	1,445	7,480	1,842	3,765	2,850	9,090.
Total number of loads	943	922	1,955	854	935	1,208.
Total amount dredged ... cubic yards	260,200	1,718,549	381,225	761,761	524,126	2,498,457.
Average distance to dump ... miles	2.66	2	1.15	2.3	1	7.
Total number of days on which any dredging was done.	182	230	207	202	184	275.
Total number of hours pumping	901	2,929	831	1,134	1,016	2,902.
Time to pump one load	57½ minutes	3 hours 10 minutes	25½ minutes	1 hour 20 minutes	1 hour 5 minutes	2 hours 24 minutes.
Total number of hours dumping	48	136	163	173	115	195.
Time to dump one load	3 minutes	7½ minutes	5 minutes	12 minutes	7½ minutes	9½ minutes.
Total number of hours going to and from dump.	583	333	570	446	316	1,705.
Total number of hours going to and from wharf.	262	38	548	314	151	127.
Total number of hours taking coal and water.	46.5	228	94	140	408	29.
Total number of hours lost on account of weather.	22	23	290	48	398	384.
Total amount of coal consumed . . long tons.	728	6,331	6,344 barrels oil	2,909	3,262	10,787.
Number of pounds of coal consumed per cubic yard of material dredged.	6.27	8.25	0.7 gallon oil	8.55	13.9	9.67.
Cost per cubic yard, including all repairs	$0.0715	$0.0628	$0.0677	$0.1147	$0.0878	$0.04.
Remarks	Repairing 1 month; laid up 3½ months.	Repairing 2 months.	Repairing 1 month; laid up 1 month.	Repairing 2 months.	In winter quarters 2 months.	

Performances of United States seagoing dredges for the fiscal year ending June 30, 1909—Continued.

Name	*Atlantic.*	*Key West.*	*Savannah.*	*Sumter.*	*Burton.*	*Caucus.*
When built	1904	1904	1904	1904	1905	1905.
Where built	Sparrows Point, Md.	Belfast, Me.	Sparrows Point, Md.	Petersburg, Va.	Sparrows Point, Md.	Greenport, N. Y.
Hull material	Steel	Wood	Steel	Wood	Steel	Wood.
Length	275 feet 7 inches	141 feet	177 feet	200 feet	177 feet	200 feet.
Beam	47 feet 7 inches	31 feet	38 feet	41 feet	38 feet	41 feet.
Depth	25 feet	15 feet	19 feet 6 inches	21 feet	19 feet	20 feet.
Displacement ... tons	2,674	498	1,236	1,650	1,200	1,650.
Speed, light ... knots	10	7	8	8	7	9.
Speed, loaded ... do	8	5	5.1	5	4	6.
Speed, dredging ... do	2 to 3	2	1 to 2	1½ to 2	1½	1.
Number and size of pumps	Two 20-inch	One 15-inch	Two 15-inch	Two 18-inch	Two 15-inch	Two 18-inch.
Number of men in crew	57	23	34	44	28	34.
Location of dredging	Ambrose Channel, New York Harbor.	Tampa Bay and St. Johns River, Fla.	Harbor bars, Savannah, Ga.	Passes of the Mississippi River, La.	Harbors Toledo and Sandusky, Ohio.	Carrabelle and Pensacola harbors, Fla.
Character of dredged material	Sand, mud, gravel, and stone.	Sand and broken shells.	Sand, clay, and mud.	Sand, clay, and mud.	Sand and mud	Sand.
Average depth of dredging	25 to 30 feet	23 to 26 feet	21 feet		22 feet	27 feet.
Average load in bins ... cubic yards	2,090	326.4	784	844	689	905.
Material pumped per hour ... do	879	285	572	366	264	678.
Average number cubic yards dredged daily	9,500	2,070	3,391	2,625	1,380	3,265.
Total number of loads	1,275	1,344	1,028	342	330	556.
Total amount dredged ... cubic yards	2,667,321	438,748	807,236	288,852	227,109	502,428.
Average distance to dump ... miles	6	0.608	3	3½	6.4	2.
Total number of days on which any dredging was done.	281	212	238	110	164	154.
Total number of hours pumping	3,036	1,538.15	1,410	790	863	745.
Time to pump 1 load	2 hours 23 minutes	1.15 hours	1 hour 22 minutes	2 hours 18 minutes	2 hours 36 minutes	1 hour 20 minutes.
Total number of hours dumping	213	167.5	150	72.25		46.
Time to dump 1 load	10 minutes	0.12 hour	8¼ minutes	12¾ minutes		5 minutes.
Total number of hours going to and from dump.	1,775	437.5	616	282	647	470.
Total number of hours going to and from wharf.	140	345⅛	317	182½	81	305.
Total number of hours taking on coal and water.	912	299½	189	73	48	112.
Total number of hours lost on account of weather.	479	11¾	30	11	59	68.
Total amount of coal consumed ... long tons	11,087	2,035.4	3,014	1,839	2,174	2,706.
Number of pounds of coal consumed per cubic yard of material dredged.	9.3	10.4	8.36	14.25	21.4	12.1.
Cost per cubic yard, including all repairs	$0.038	$0.091	$0.07	$0.105	$0.11	$0.0784.
Remarks			Laid up 1 month overhauling.	Worked 6 months; now undergoing repairs.	Winter quarters 4 months.	

Name	*Delaware.*	*St. Johns.*	*Navesink.*	*Raritan.*	*Clatsop.*	*Galveston.*
When built	1905	1905	1908	1908	1908	1908.
Where built	Sparrows Point, Md.	Greenport, N. Y.	Sparrows Point, Md.	Sparrows Point, Md.	Newport News, Va.	Sparrows Point, Md.
Hull material	Steel	Wood	Steel	Steel	Steel	Steel.
Length	315 feet	205 feet	290 feet	290 feet	180 feet	304 feet.
Beam	52 feet	41 feet	47 feet 7 inches	47 feet 7 inches	38 feet	51 feet.
Depth	22 feet 6 inches	20 feet	28 feet	28 feet	20 feet 6 inches	27 feet.
Displacement ... tons	2,750	1,047	2,929	2,929	1,100	3,500.
Speed, light ... knots	9½	9	10	10	10	11.
Speed, loaded ... do	5½	5	8	8	6	8.
Speed, dredging ... do	1 7/10	1	2 to 3	2 to 3	1 to 2	1.
Number and size of pumps	Two 20-inch	Two 18-inch	Two 20-inch	Two 20-inch	Two 18-inch	Two 20-inch.
Number of men in crew	57	49	60	60	34	58.
Location of dredging	Delaware River, Del.	Passes of the Mississippi River, La.	Ambrose Channel, New York Harbor.	Ambrose Channel, New York Harbor.	Delaware River, Del., and Portland, Oreg.	Galveston Harbor, Tex.
Character of dredged material	Sand, mud, gravel, clay, and broken stone.	Sand, mud, and clay.	Sand, gravel, mud	Sand, stones, mud, débris.	Sand, mud, and clay.	Sand, mud, and clay.
Average depth of dredging	28½ feet	30 to 35 feet	30 feet	25 to 30 feet	24 feet	29 feet.
Average load in bins ... cubic yards	3,170	637	2,530	2,660	846	2,040.
Material pumped per hour ... do	871	497	876	995	386	707.
Average number cubic yards dredged daily	9,590	3,160	9,320	10,750	1,910	9,160.
Total number of loads	647	1,059	1,042	1,125	115	623.
Total amount dredged ... cubic yards	2,050,222	670,584	2,636,123	3,002,537	97,404	1,272,659.
Average distance to dump ... miles	6	1	7½	7½		1.
Total number of days on which any dredging was done.	214	212	283	279	51	139.
Total number of hours pumping	2,356	1,348	3,010	3,021	252	1,802.
Time to pump 1 load	3 hours 39 minutes	1 hour 16 minutes	2 hours 53 minutes	2 hours 41 minutes	2 hours 10 minutes	2 hours 54 minutes.
Total number of hours dumping	121	133	200	197	24	186.
Time to dump 1 load	11 minutes	7½ minutes	11½ minutes	10½ minutes		18 minutes.
Total number of hours going to and from dump.	826	421	1,622	1,852		265.
Total number of hours going to and from wharf.	22	198	185	131		97.
Total number of hours taking on coal and water.	394	205	27	None, coaled Sundays.		103.
Total number of hours lost on account of weather.	302	72	312	321		373.
Total amount of coal consumed ... long tons	8,045	4,014	10,652	10,854		27,373 barrels.
Number of pounds of coal consumed per cubic yard of material dredged.	8.8	13.3	9.1	8.1		0.915 gallon.
Cost per cubic yard, including all repairs	$0.0413	$0.11	$0.041	$0.03865	$0.144	$0.0588.
Remarks	2½ months repairing.	Repairing 1 month.			Put in commission this year; 2 months trials, 5 days regular operations.	Put in commission this year; operated 7 months; uses oil for fuel.

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

For examinations, surveys, and contingencies of rivers and harbors, an appropriation of $350,000 should be made, as follows:

For examinations, surveys, and contingencies, and for incidental repairs for rivers and harbors for which there may be no special appropriation; for expenses connected with the inspection of bridges or other structures reported as obstructions to navigation, with the service of notices and holding of hearings when required in such cases, with the location of harbor lines under the act of March 3, 1899, and with the examinations and reports by officers of the Corps of Engineers, and by boards of engineers upon plans and sites for bridges or other structures authorized by law to be built, and upon bills authorizing bridges or other structures, reports upon which may be called for by Congress; and for other expenses connected with the performance of the duties which are, or may be, imposed by law upon the War Department in the protection and preservation of the navigable waters of the United States.

SUPERVISION OF THE HARBOR OF NEW YORK.

The supervisor of the harbor during the past year was Capt. Aaron Ward, U. S. Navy.

The office of supervisor of the harbor of New York was created by act of Congress approved June 29, 1888, entitled "An act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City, by dumping or otherwise, and to punish and prevent such offenses." This act has been amended by section 3 of the act of August 18, 1894, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," by which amendment the functions and powers of the officer have been greatly enlarged. Additional duties are also conferred on the supervisor by section 2 of the last-named act. The functions and powers of the supervisor have been further extended by section 8 of act of Congress approved May 28, 1908, entitled "An act to amend the laws relating to navigation, and for other purposes."

Under the provisions of section 5 of the act of June 29, 1888, a line officer of the Navy is designated to discharge the duties created by the act, under the direction of the Secretary of War. On May 23, 1889, the Secretary of War directed that all communications in connection with these duties should be addressed to him through this office, and on February 1, 1890, he further directed that the powers conferred upon him by the act should be exercised through the Chief of Engineers.

The report of Captain Ward for the past fiscal year is submitted herewith as Appendix A A A.

Estimates for the fiscal year ending June 30, 1911.—The estimates of funds required for this service for the fiscal year ending June 30, 1911, are given in the above-mentioned report, as follows:

For pay of inspectors, deputy inspectors, office force, and expenses of office	$10,260.00
For pay of crews and maintenance of patrol fleet	75,000.00
For renewing engines and boilers of steam tug *Vigilant*	15,000.00
Total	100,260.00

CALIFORNIA DÉBRIS COMMISSION.

Unrestricted mining by the hydraulic process in California resulted in enormous quantities of débris being washed down into the rivers and natural water courses draining the western slopes of the Sierras. Later on hydraulic mining was practically prohibited by the decisions of the courts on account of injury to streams and the adjacent private land.

The act of Congress approved March 1, 1893, created the California Débris Commission, stipulating that the commission should consist of three officers of the Corps of Engineers, appointed by the President with the concurrence of the Senate. The same act prescribed the duties of the commission, which are, first, the regulation of hydraulic mining in the territory drained by the Sacramento and San Joaquin river systems, so that mining by that method may be resumed and carried on without injury to other interests in the State, and, second, to mature and adopt plans to improve the navigability of the above-mentioned rivers, to protect same from damage due to mining débris, and to afford relief thereto in flood time.

Regulation of hydraulic mining.—Up to June 30, 1909, the commission received 852 applications for permits to mine by the hydraulic process under the restrictions imposed by the act of Congress of March 1, 1893, and granted permits in cases where means for properly impounding the débris were provided by the applicants.

Improvement and protection of rivers and flood control.—The Yuba River, a tributary of the Feather, which in turn is a tributary of the Sacramento River, was the first selected for treatment, this stream being more filled with débris and carrying more detritus than all the other tributaries of the Sacramento combined. The general project for the treatment of the Yuba was printed in the Annual Report of the Chief of Engineers for 1900, part 8, page 5030. The estimated total cost of this project was placed at $800,000. It was adopted by act of Congress approved June 13, 1902. The estimated total cost of the project has been appropriated—$400,000 by Congress and $400,000 by the legislature of California, the appropriations by Congress stipulating that one-half the cost of the work should be paid by the State of California.

The Yuba River project contemplates holding the great quantities of mine débris now in that stream and tributaries, to prevent it from being carried down into the Feather and Sacramento rivers, this to be accomplished by restraining barriers, or dams, across the bed of the Yuba, by a settling basin adjoining the river on the south, and by training walls below.

The amount expended by the United States on the existing project for the work in the Yuba River up to June 30, 1909, was $297,745.27. These expenditures were principally in payment of one-half the purchase price of upward of 10,000 acres of land; in payment of one-half the cost of the construction of portions of barriers, or dams, in Yuba River, known as Nos. 1 and 2; of one-half the cost of excavating a flood-overflow channel through the promontory on Yuba River known as Daguerre Point; of one-half the cost of constructing a portion of the proposed training walls to confine the flow of Yuba River below Daguerre Point; and of one-half the cost of constructing a portion of the proposed débris-settling basin on the south side of Yuba River in the vicinity of Daguerre Point.

The expenditures during the past fiscal year were in payment of one-half the cost of constructing portions of the training walls and portions of the proposed débris-settling basin in the vicinity of Daguerre Point.

In a special report dated June 30, 1907 (submitted to comply with sections 5, 6, and 7 of the act of Congress of March 1, 1893), printed in the Annual Report of the Chief of Engineers for 1907, pages 2262–2269, the commission estimated that the restraining works already constructed and remaining to be built under the present project for the treatment of Yuba River would provide capacity for storing 60,000,000 cubic yards of débris in that stream. The commission stated in this special report, however, that dredging was considered the most feasible method to meet the requirements of all the interests involved—navigation, protection from flood overflow, better drainage, and disposal and control of débris in the Sacramento and Feather rivers, and submitted an estimate of $800,000 for beginning this work. This estimate was submitted by the commission with the provision that one-half should be appropriated by the State of California. The State of California on March 1, 1909, appropriated $400,000 for this purpose with the stipulation that—

> SEC. 2. This act shall become operative only upon condition that the Government of the United States shall, under, by, and through the War Department, assume full charge and control of all work to be done as provided by this act, and also upon condition that a like sum of four hundred thousand dollars be appropriated by the United States for such work.

The appropriation made by the State of California also contains the provision that "the whole of such amounts appropriated by the Congress of the United States and by the State of California shall be expended under the direction of the Secretary of War and the supervision of the Chief of Engineers."

The commission reports that from surveys made and from other surveys soon to be completed data will be available for use in preparing, during the ensuing year, a project for thorough control of the rivers at all stages.

The maintenance of navigation on the Sacramento and San Joaquin river systems is important. Upward of 1,000,000 tons of freight and 300,000 passengers are carried annually by vessels of all classes plying the Sacramento, San Joaquin, Mokelumne, and Feather rivers. The freight consists principally of grain, mill stuffs, lumber, groceries, fruit, vegetables, and general merchandise, and is carried principally on barges towed by steamboats and on scow-schooners. About 45 steamboats, many barges, launches, and scow-schooners are engaged in this trade.

Much of the fertile country along the Sacramento and San Joaquin rivers is without railroad transportation, owing to the expense and difficulties of the construction and maintenance of railroads in a lowland country which is subject to more or less widespread floods annually. These fertile lands, great areas of which are under a high state of cultivation, are protected ordinarily from overflow by extensive levee systems, constructed and maintained at great expense, and the rivers are in many cases the only means of transporting freight and passengers to and from most of this country. The lower rates by river to some points which can also be reached by railroads are in some cases met by the latter.

The following statement shows the present condition for purposes of navigation of the three principal streams comprising the Sacramento and San Joaquin river systems:

	Sacramento River.	Feather River.	San Joaquin River.
Maximum draft that can be carried at low water.	San Francisco to Sacramento, 7 feet; Sacramento to Colusa, 4 to 5 feet; Colusa to Red Bluff, 2 to 2½ feet.	Mouth of river to Marysville, 1 to 2 feet.	Mouth of river to Stockton, 6 feet; Stockton to Firebaugh, a few inches.
Head of navigation	Red Bluff	Marysville	Stockton (Firebaugh, 4 months in year).
Length of navigable portions.	Mouth to Sacramento, 61 miles; mouth to Colusa, 152 miles; mouth to Red Bluff, 262 miles.	Mouth to Marysville, 30 miles.	Mouth to Stockton, 50 miles; mouth to Firebaugh, 200 miles.

More extended information concerning navigation, flood control, and the mine débris question in and along the Sacramento and San Joaquin rivers and their tributaries may be found in the document and reports referred to in the Annual Report of the Chief of Engineers for 1908 (pt. 1, p. 861), and in House Documents Nos. 1123 and 1124, Sixtieth Congress, second session.

The members of the commission during the past fiscal year were the following officers of the Corps of Engineers, U. S. Army: Lieut. Col. John Biddle; Maj. C. H. McKinstry, to June 7, 1909; Capt. Thos. H. Jackson; and First Lieut. Charles T. Leeds, since June 7, 1909.

The appended money statement for appropriation for restraining mine débris in California includes only funds appropriated by Congress, and does not include funds appropriated by the legislature of California.

APPROPRIATION FOR EXPENSES OF CALIFORNIA DÉBRIS COMMISSION, 1909.

July 1, 1908, amount appropriated by act of Congress approved May 27, 1908	$15,000.00
June 30, 1909, amount expended during fiscal year	[a] 13,124.85
July 1, 1909, balance unexpended	1,875.15
July 1, 1909, outstanding liabilities	1,825.15
July 1, 1909, balance reverting to Treasury	50.00

APPROPRIATION FOR EXPENSES OF CALIFORNIA DÉBRIS COMMISSION, 1910.

Amount appropriated by act of Congress approved March 4, 1909	$15,000.00
Amount (estimated) required for expenses of the California Débris Commission during the fiscal year ending June 30, 1911, in regulating hydraulic mining operations in the State of California, making examinations and surveys for improvement of navigation, control and disposition of mine débris, and control of flood waters as required by the act of Congress approved March 1, 1893	15,000.00

---

[a] In addition there was expended during the year $2.09 from appropriation for fiscal year 1907 and $1,142.75 from appropriation for fiscal year 1908.

APPROPRIATION FOR RESTRAINING MINE DÉBRIS IN CALIFORNIA.

July 1, 1908, balance unexpended	$132,042.54
Amount received from sales	503.78
	132,546.32
June 30, 1909, amount expended during fiscal year, for works of improvement	29,659.81
July 1, 1909, balance unexpended	102,886.51
July 1, 1909, outstanding liabilities payable by United States	9,955.60
July 1, 1909, balance available	92,930.91
July 1, 1909, amount of United States funds covered by uncompleted contracts	7,043.38

(See Appendix B B B.)

EXAMINATION OF MISSISSIPPI RIVER WITH A VIEW TO PROVIDING AND MAINTAINING A NAVIGABLE CHANNEL 14 FEET DEEP AND OF SUITABLE WIDTH FROM ST. LOUIS TO THE MOUTH.

Under the provisions of the river and harbor act of March 2, 1907, a commission has been appointed to examine the Mississippi River below St. Louis and report upon the practicability and desirability of constructing and maintaining a navigable channel 14 feet deep and of suitable width from St. Louis to the mouth of the river either by open-channel improvement or by a canal or canals for part of said route. The commission is also required by the act to consider in this connection the survey of a proposed waterway from Chicago to St. Louis heretofore reported upon (see H. Docs. No. 263, 59th Cong., 1st sess., and No. 437, 59th Cong., 2d sess.), and also to report upon any water power which may be created in the said section of the Mississippi River below St. Louis, as well as in the proposed waterway from Chicago to St. Louis, and what steps, if any, should be taken to cause the cost of improvement to be defrayed in whole or in part by means of such water power or of lands which may be drained by either of said waterways.

The members of the commission are Col. W. H. Bixby, Corps of Engineers, president, Mississippi River Commission; Lieut. Col. C. McD. Townsend, Corps of Engineers; Lieut. Col. J. G. Warren, Corps of Engineers; Mr. Henry B. Richardson, member of the Mississippi River Commission, and Mr. Homer P. Ritter, member of the Mississippi River Commission, with Capt. G. R. Lukesh, Corps of Engineers, as recorder.

Report dated March 20, 1909, was duly submitted and was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. The report was transmitted to Congress and printed in House Document No. 50, Sixty-first Congress, first session.

The sum of $190,000 was appropriated by the act to defray the expense of the survey, of which $177,065.02 had been expended to June 30, 1909. The expenditure during the year amounted to $65,040.19.

MISSISSIPPI RIVER COMMISSION.

The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including the rectification of Red and Atchafalaya rivers at their junction with the Mississippi, the building of levees, and the improvement of the several harbors for which specific appropriations have been made, with the exception of the harbor of Vicksburg and the mouth of Yazoo River. It is also charged with the survey of the Mississippi River from Head of Passes to its headwaters, and with gauging the river and its tributaries.

The river and harbor acts of March 3, 1905, and March 2, 1907, prescribed that the money therein appropriated and authorized to be expended should be applied to the construction of suitable and necessary dredge boats and other devices and appliances and in the maintenance and operation of the same, with the view of ultimately obtaining and maintaining a navigable channel from Cairo down not less than 250 feet in width and 9 feet in depth at all periods of the year, except when navigation is closed by ice. They also authorized allotments from such funds in the discretion of the Commission and upon approval by the Chief of Engineers, to be applied to the water courses connected with the river and the harbors upon it now under the control of the Mississippi River Commission.

Act of Congress approved June 4, 1906, provides that any funds which have been, or may hereafter be, appropriated by Congress for improving the Mississippi River between the Head of Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, upon levees upon any part of said river between the Head of Passes and Cape Girardeau, Mo.

The act of March 2, 1907, provided for prosecution of the work under continuing contract and authorized expenditures in the sum of $6,000,000 (of which $2,000,000 yet remains to be appropriated), provided that this sum shall be used in improvement for not less than three years, the work done each year to cost approximately $2,000,000.

The commissioners during the past fiscal year were Col. Wm. H. Bixby, Corps of Engineers, president; Col. Wm. T. Rossell, Corps of Engineers; Lieut. Col. J. G. Warren, Corps of Engineers; Homer P. Ritter, assistant, United States Coast and Geodetic Survey; Robert S. Taylor, J. A. Ockerson, and Henry B. Richardson.

Capt. G. R. Lukesh, Corps of Engineers, was on duty as secretary to the Commission to November 30, 1908, and First Lieut. C. H. Knight, Corps of Engineers, since that date.

Estimate for the fiscal year ending June 30, 1911.—The following estimate of funds required for carrying on the works under its charge for the year ending June 30, 1911, is submitted by the commission:

For continuing the improvement of Mississippi River from Head of Passes to the mouth of the Ohio River, including salaries and clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission	$4,000,000

The estimate has been reduced in this office to $2,000,000, this being the limit of expenditure at present authorized by Congress.

The report of the commission on the operations under its charge during the fiscal year ending June 30, 1909, is submitted herewith as Appendix P P P of this report.

PERMANENT INTERNATIONAL COMMISSION OF THE CONGRESSES OF NAVIGATION.

By act approved June 28, 1902, Congress appropriated the sum of $3,000 per year for the support and maintenance of the Permanent International Commission of the Congresses of Navigation and for the payment of the actual expenses of the properly accredited national delegates of the United States to the meeting of the Congresses and of the Commission.

At the beginning of the fiscal year the United States was represented on the Permanent International Commission of the Congresses of Navigation by Brig. Gen. C. W. Raymond, U. S. Army, retired; Mr. E. L. Corthell, civil engineer; Lieut. Col. H. F. Hodges, Corps of Engineers; Lieut. Col. J. C. Sanford, Corps of Engineers, and Mr. John Bogart, civil engineer. On the permanent executive committee of that Commission it was represented by General Raymond as the principal representative and Mr. E. L. Corthell as the substitute. The representation on the Commission and on the executive committee has remained unchanged during the year. Colonel Sanford attended a meeting of the Commission held at Brussels, Belgium, May 17, 1909; also a meeting of the executive committee held May 15, 1909, neither of the regular members representing the United States being able to be present.

The expenditures during the year from the appropriation made by Congress amounted to $3,860.50, and have been for the expenses of the American Section in attending its meetings and of the delegate to the meeting of the Permanent International Commission of the Congresses of Navigation, for the maintenance of the executive office of the American Section, for the printing and distribution of circulars issued by the Section, and for the support and maintenance of the commission, to which the United States contributes $1,000 per annum.

ESTABLISHMENT OF HARBOR LINES.

Under authority given to the Secretary of War in section 11 of the river and harbor act approved March 3, 1899, harbor lines have been established during the past fiscal year at the following localities, under dates as indicated:

East side of Hudson River, between Adams street and Burden Iron Works, Troy, N. Y., approved March 13, 1909; Red Hook Point, Brooklyn, N. Y., modification approved March 19, 1909; Arthur Kill, between Buckwheat Island and Morse Creek, N. J., approved October 8, 1908; Delaware and Schuylkill rivers at Philadelphia, Pa., approved September 4, 1908; Absecon Inlet, Atlantic City, N. J., approved January 23, 1909; Curtis Bay, Baltimore Harbor, Md., south side, approved May 25, 1909; Potomac River at Alexandria, Va., approved June 1, 1909; Mobile River at Pinto Island, approved

February 13, 1909; Missouri River at Omaha, Nebr., approved June 5, 1909; Monongahela River from Brownsville near Lock No. 5 to Lock No. 6, at Rices Landing, Pa., approved June 5, 1909; Allegheny River, Pennsylvania, from Lock No. 2 to upper end of Brilliant Pumping Station, modification approved September 5, 1908; Ohio River from Dam No. 3, at Glen Osborne, Pa., to Dam No. 5, near Rochester, Pa., approved May 29, 1909; Muskingum River above and below Lock and Dam No. 10, at Zanesville, Ohio, approved June 25, 1909; Duluth-Superior Harbor in front of Minnesota Point, Minnesota and Wisconsin, approved September 21, 1908; Manitowoc River at Manitowoc, Wis., approved July 6, 1908; Inner Harbor of San Pedro, Cal., approved unconditionally July 29, 1908; San Francisco Bay, California, between point San Pablo and Castro Rocks, modification approved May 22, 1909; Swinomish Slough at La Conner, Wash., approved October 9, 1908; Kahului Harbor, Hawaii, approved April 22, 1909.

RULES AND REGULATIONS GOVERNING THE NAVIGATION OF CANALS, ETC.

Section 4 of the river and harbor act of August 18, 1894, as amended by section 11 of the river and harbor act of June 13, 1902, delegates to the Secretary of War the duty of prescribing such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are or that hereafter may be owned, operated, or maintained by the United States as in his judgment the public necessity may require; and he is also authorized to prescribe regulations to govern the speed and movement of vessels and other water craft in any public navigable channel which has been improved under authority of Congress whenever in his judgment such regulations are necessary to protect such improved channels from injury or to prevent interference with the operations of the United States in improving navigable waters or injury to any plant that may be employed in such operations. Such rules and regulations have been established during the past year for the following-named localities:

Tampa and Hillsboro bays, Florida; Apalachicola Harbor, inner channel, Florida; Southwest Pass, Mississippi River, La.; Port Arthur Ship Canal, the Sabine-Neches Canal and part of Taylors Bayou, Texas; Buffalo Bayou, Texas; Duluth-Superior Harbor, Minnesota and Wisconsin; St. Clair River, Michigan; Columbia and Willamette rivers, Oregon; San Juan Harbor, Porto Rico, channel leading to.

RULES AND REGULATIONS GOVERNING THE OPENING OF DRAWBRIDGES.

Section 5 of the river and harbor act of August 18, 1894, provides hat it shall be the duty of all persons owning, operating, and tendng the drawbridges then built or which might thereafter be built cross the navigable rivers and other waters of the United States to pen or cause to be opened the draws of such bridges, under such rules nd regulations as in the opinion of the Secretary of War the public nterests require, for the passage of vessels and other water craft. uch rules and regulations have been established during the past year by the Secretary of War for certain drawbridges over the following-named waterways:

Spa Creek, between Annapolis and Eastport, Md.; Mackeys Creek, North Carolina; Galena River, Illinois; St. Croix River, Wisconsin and Minnesota; Kalamazoo River between Douglas and Saugatuck, Mich.

RULES AND REGULATIONS FOR THE NAVIGATION OF STREAMS ON WHICH THE FLOATING OF LOOSE TIMBER AND SACK RAFTS OF TIMBER AND LOGS IS THE PRINCIPAL METHOD OF NAVIGATION.

Under the provisions of act of Congress approved May 9, 1900, "An act authorizing the Secretary of War to make regulations governing the running of loose logs, steamboats, and rafts on certain rivers and streams," the Secretary of War has prescribed rules and regulations for the navigation of the "Inland route," so called, and connecting waters between Cheboygan and Conway, Mich.

STRUCTURES IN THE NAVIGABLE WATERS OF PORTO RICO.

Act of Congress approved June 11, 1906, empowered the Secretary of War, under certain restrictions, to authorize the construction, extension, and maintenance of wharves, piers, and other structures on lands underlying harbor areas and navigable streams and bodies of water in or surrounding Porto Rico and the islands adjacent thereto.

Through a conference between the district officer and the governor of Porto Rico a definite policy has been established and is followed in connection with applications for privileges under this law, several applications having been acted on during the year.

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

Plans and maps of locations of the following bridges proposed to be erected under the authority of special acts of Congress have been examined with a view to protection of the interests of navigation and have been approved by the Secretary of War, as provided by the acts, and the local engineer officers have been furnished copies of the instruments of approval and drawings showing the plans and locations and charged with the supervision of the construction of the bridges, so far as necessary, to see that they are built in accordance with the approved plans:

Bridge of Allegheny and Washington counties, Pa., over Monongahela River at Monongahela city.—Plans and map of location of a bridge at this place authorized by act of Congress approved April 3, 1908, were approved May 21, 1908, and modified drawings supplemental to those attached to original instrument were approved July 5, 1908.

Bridge of the Chicago, Indianapolis and Louisville Railroad Company, over Calumet River at Hammond, Ind.—Reconstruction of this bridge was authorized by act of Congress approved February 20, 1908. Plans were approved July 29, 1908.

Bridge of the Seaboard Air Line Railroad Company over Savannah River at Hutchinson Island, Georgia.—Plans for the reconstruction of an existing bridge at this place were approved November 12, 1908.

Bridge of the city of Chicago over Calumet River at Ninety-second street.—Plans for a bridge to replace an existing structure at this place were approved November 12, 1908.

Bridge of Okanogan County, Wash., over Okanogan River at Okanogan.—Construction of this bridge was authorized by act of Congress approved May 20, 1908. Plans and map of location were approved January 8, 1909.

Bridge of the St. Paul Bridge and Terminal Railway Company over Mississippi River at St. Paul, Minn.—Construction of this bridge was authorized by act of Congress approved December 18, 1908. Plans and map of location were approved February 16, 1909.

Bridge of the Delaware, Lackawanna and Western Railroad Company over Delaware River near Columbia, N. J., and Slateford, Pa.—Construction of this bridge was authorized by act of Congress approved January 14, 1909. Plans and map of location were approved March 9, 1909.

Bridge of Carter County, Mo., over Current River near Van Buren Ferry.—Construction of this bridge was authorized by act of Congress approved February 1, 1909. Plans and map of location were approved April 8, 1909.

Bridge of the Iowa Central Railway Company over Mississippi River at Keithsburg, Ill.—Reconstruction of this bridge was authorized by act of Congress approved February 25, 1909. Plans were approved April 12, 1909.

Bridge of the Santee River Cypress Lumber Company over Santee River near Ferguson, S. C.—Construction of this bridge was authorized by act of Congress approved February 6, 1909. Plans and map of location were approved April 14, 1909.

Bridge of the Chicago, Lake Shore and Eastern Railway Company, over Calumet River near Gary, Ind.—Construction of this bridge was authorized by act of Congress approved March 3, 1909. Plans and map of location were approved April 26, 1909.

Bridge of Behn Brothers over Condado Bay at San Juan, P. R.—Construction of this bridge was authorized by act of Congress approved February 25, 1909. Plans and map of location were approved April 29, 1909.

Bridge of the Northern Pacific Railway Company over St. Louis River (Grassy Point Bridge) between Duluth, Minn., and Superior, Wis.—Construction of a bridge at this place was authorized by act of Congress approved January 3, 1887. Plans for a bridge to replace an existing structure at this point were approved May 10, 1909.

Bridge of the North Coast Railroad Company over Columbia River n Benton and Walla Walla counties, Wash.—Construction of this ridge was authorized by act of Congress approved January 29, 1907. lans and map of location were approved May 13, 1909.

Bridge of the city of St. Louis, Mo., over Mississippi River in that ty.—Construction of this bridge was authorized by act of Congress pproved June 25, 1909. Plans and map of location were approved ecember 17, 1908. Modified plans were approved May 20, 1909.

Bridge of the Brownsville and Gulf Railway Company over Rio ande River at Brownsville, Tex., and Matamoras, Mexico.—Conuction of this bridge was authorized by act of Congress approved

May 20, 1908, as amended by joint resloution approved May 22, 1908. Plans and map of location were approved May 21, 1909.

Bridge of the Atlantic Coast Line Railroad Company over Savannah River at Savannah, Ga.—Plans for the reconstruction of an existing structure were approved May 21, 1909.

Bridge of the Louisville and Nashville Railroad Company over Coosa River at Gadsden, Ala.—Plans for reconstructing an existing bridge at this place were approved June 16, 1909.

Bridge of Manistee Township, Mich., over Manistee River at Manistee.—Construction of this bridge was authorized by act of Congress approved May 20, 1908. Plans and map of location were approved August 15, 1908.

Under the provisions of section 9 of the river and harbor act approved March 3, 1899, bridges may be built over navigable waters entirely within the limits of any State, under authority of legislative enactments of such State, when the plans and locations of the structures are approved by the Secretary of War. Plans and maps of locations of the following bridges proposed to be erected under these provisions have been examined with a view to protection of the interests of navigation and have been approved by the Secretary of War, and the local engineer officers have been furnished copies of the drawings and instruments of approval and charged with the supervision of construction of the bridges, so far as necessary, to see that they are built in accordance with the approved plans:

Bridge of the Atlantic Coast Line Railroad Company over Scotts Creek at Hospital and Pinner points, Virginia.—Plans for reconstructing an existing bridge at this place were approved July 6, 1908.

Bridge of the Day Island Company over Day Island Waterway near Tacoma, Wash.—Plans and map of location were approved July 15, 1908.

Bridge of the Baltimore and Ohio Railroad Company over Susquehanna River at Havre de Grace, Md.—Plans for the reconstruction of an existing structure were approved July 27, 1908.

Bridge of Atlantic County, N. J., over Inside Thoroughfare at Ventnor.—Plans for replacing an existing structure at this place were approved July 30, 1908.

Bridge of town of Handsboro, Miss., over Bayou Bernard at that place.—Plans and map of location were approved July 30, 1908.

Bridge of Warren County, Miss., over Big Black River at Ivanhoe Ferry.—Plans and map of location were approved September 25, 1907. Modified plans were approved August 10, 1908.

Bridge of the Congress Street Bridge Commission of Bridgeport, Conn., over Poquonnock River in that city.—Plans for a bridge to replace an existing structure were approved August 12, 1908.

Bridge of the Seattle Electric Company across East and West waterways in Seattle Harbor, Washington.—Plans and map of location were approved August 15, 1908.

Bridge of King County, Wash., over White River at Orillia.—Plans and map of location were approved August 15, 1908.

Bridge of the Seattle Electric Company over portage between Lakes Union and Washington at Seattle, Wash.—Plans for this bridge were approved August 17, 1908.

Bridge of Perry County, Ark., over Fourche Le Fevre River near Houston.—Plans and map of location were approved August 17, 1908.

Bridge of Hudson County, N. J., across Hackensack River, at Newark avenue, Jersey City.—Plans for rebuilding an existing structure at this place were approved July 20, 1906, and plans supplemental thereto were approved August 22, 1908.

Bridge of Warren County, Miss., over Big Black River at Hankinson Ferry.—Plans for rebuilding an existing bridge at this place were approved August 22, 1908.

Bridge of Harrison County, Miss., over Tchoutacabouffa River, below Morris Ferry.—Plans and map of location were approved August 27, 1908.

Bridge of the Bath-Rowan Bridge Company over Licking River at Farmers, Ky.—Plans and map of location were approved September 1, 1908.

Bridge of the Logan and Southern Railway Company over Guyandot River at Logan, W. Va.—Plans and map of location were approved September 1, 1908.

Bridge of the New Iberia, St. Martin and Northern Railroad Company over Bayou Teche, near Wyche Plantation, Louisiana.—Plans and map of location were approved September 3, 1908.

Bridge of the Montgomery Bridge Company over Kanawha River at Montgomery, W. Va.—Plans and map of location for this bridge were approved September 5, 1907. Map of new location was approved September 8, 1908. New approval in name of Montgomery and Cannelton Bridge Company and former approval canceled February 16, 1909.

Bridge of Venango County, Pa., over Allegheny River at Oil City.—Plans and map of location of bridge to replace an existing structure were approved September 14, 1908.

Bridge of the city of Chicago, Ill., over South Fork of South Branch of Chicago River.—Plans and map of location were approved September 14, 1908.

Bridge of Muskegon County, Mich., over Muskegon River.—Plans and map of location were approved September 18, 1908.

Bridge of Snohomish County, Wash., over Stilaguamish River, near Stanwood, Wash.—Plans and map of location were approved September 24, 1908.

Bridge of the city of Ottawa, Ill., over Illinois River at that place.—Plans and map of location were approved September 22, 1908.

Bridge of Leake County, Miss., over Pearl River at Carthage.—Plans for rebuilding an existing bridge at this place were approved September 30, 1908.

Bridge of Quitman County, Miss., over Coldwater River near Darling.—Plans and map of location were approved October 2, 1908.

Bridge of Hernando County, Fla., over Withlacoochee River at Istachatta.—Plans and map of location were approved October 8, 1909.

Bridge of the Havre de Grace and Perryville Bridge Company, over Susquehanna River at Havre de Grace, Md.—Plans for reconstructing an existing bridge at this place were approved October 22, 1908.

Bridge of the city of Green Bay, Wis., over Fox River at that place.—Plans and map of location were approved October 26, 1908.

Bridge of Lee and De Soto counties, Fla., over Caloosahatchee River at Labelle.—Plans and map of location were approved October 28, 1908.

Bridge of the New Orleans and Northwestern Railroad Company over Tensas River, near Daniels Ferry, La.—Plans for rebuilding an existing structure at this place were approved October 29, 1908.

Bridge of Jones County, N. C., over Trent River in said county.—Plans for rebuilding an existing structure were approved October 30, 1908.

Bridge of Essex County, Va., over Piscataway Creek.—Plans for rebuilding an existing structure were approved November 4, 1908.

Bridge of Kamiah Bridge Company, Limited, over Clearwater River near Kamiah, Idaho.—Plans and map of location were approved August 29, 1908. Modified plans were approved November 12, 1908.

Bridge of Fairmount Coal Company over Redbank Creek, near New Bethlehem, Pa.—Plans and map of location were approved November 12, 1908.

Bridge of the city of Oswego, N. Y., over Oswego River in that city.—Plans for reconstructing an existing bridge were approved November 17, 1908.

Bridge of Cabell County, W. Va., over Guyandot River at Barboursville.—Plans and map of location were approved November 17, 1908.

Bridge of Bergen County, N. J., over Hackensack River at Hackensack and Ridgefield Park.—Plans and map of location were approved December 12, 1908.

Bridge of the Grays Harbor and Puget Sound Railway Company over Hoquiam River at Hoquiam, Wash.—Plans and map of location were approved December 12, 1908.

Bridge of Coos County, Oreg., over South Slough in that county.—Plans and map of location were approved December 12, 1908.

Bridge of the Pittsburg, Fort Wayne and Chicago Railroad Company over Chicago River at Nineteenth street, Chicago, Ill.—Plans and map of location for this bridge were approved April 17, 1907. Modified plans were approved December 15, 1908.

Bridge of Dade County, Fla., over North Fork of Miami River.—Plans and map of location were approved December 17, 1908.

Bridge of the Oregon and Washington Railroad Company over Columbia Slough in Multnomah County, Oreg.—Plans and map of location were approved December 23, 1908.

Bridge of the Grays Harbor and Puget Sound Railway Company over Chehalis River near Centralia, Wash.—Plans and map of location were approved December 23, 1908.

Bridge of the Union Pacific Railroad Company over Kansas River at Kansas City, Kans.—Plans for rebuilding an existing structure at this place were approved January 7, 1909.

Bridge of the city of Milwaukee, Wis., over Milwaukee River at Michigan street, that city.—Plans for a bridge to replace an existing structure at this place were approved January 9, 1909.

Bridges of the highway commission of the State of Washington over Deception and Canoe passes connecting Whidbey Pass and Fidalgo islands.—Plans and maps of location for these bridges were approved January 9, 1909.

Bridge of the Seattle Electric Company over Lake Union at Seattle, Wash.—Plans and map of location of a temporary structure were approved November 17, 1908. Change of location was approved January 15, 1909.

Bridge of the city of New York over Hutchinson River (East Chester Creek) at Boston Post-Road, borough of the Bronx.—Plans and map of location for a temporary and a permanent bridge to replace an existing structure were approved January 15, 1909.

Bridge of the Mount Desert Transit Company over Mount Desert Narrows between Trenton and Eden, Me.—Plans and map of location were approved January 25, 1909.

Bridge of the city of Sheboygan, Wis., over Sheboygan River in that city.—Plans and map of location for a bridge to replace an existing bridge were approved January 26, 1909.

Bridge of the Cleveland Terminal and Valley Railroad Company over Cuyahoga River at Cleveland, Ohio.—Plans and map of location were approved January 28, 1909.

Bridge of Putnam County, Fla., over St. Johns River at Palatka.—Plans and map of location were approved February 6, 1909.

Bridges of H. H. Taylor, trustee, for Bellingham Bay and British Columbia Railway Company, over Whatcom Creek and Sanalicum Creek waterways, Bellingham Bay, Washington.—Plans and maps of location were approved February 6, 1909.

Bridge of the Illinois Central Railroad Company over Wolf River near Memphis, Tenn.—Plans and map of location were approved February 9, 1909.

Bridge of Whatcom County, Wash., over new mouth of Nooksak River (Larrabee Slough) at Marietta.—Plans for reconstructing a bridge at this place were approved March 11, 1909.

Bridge of Chicago, Milwaukee and Puget Sound Railway Company over Puyallup River at Tacoma, Wash.—Plans and map of location were approved March 15, 1909.

Bridge of Florida East Coast Railway Company over New River near Fort Lauderdale, Fla.—Plans for reconstructing an existing bridge at this place were approved February 8, 1909. Modified plans were approved March 19, 1909.

Bridge of King County, Wash., over Squak Slough (Sammamish River) near Redmond.—Plans for rebuilding an existing structure at this place were approved March 19, 1909.

Bridge of Essex County, Mass., over Merrimac River between Newburyport and Deer Island.—Plans for rebuilding an existing structure were approved April 8, 1909.

Bridge of the Manatee Bridge Company over Manatee River at Manatee, Fla.—Plans and map of location were approved April 12, 1909.

Bridge of the Pittsburg, Shawmut and Northern Railroad Company ver Allegheny River near Bullis Mills, Pa.—Plans and map of location were approved April 13, 1909.

Bridge of the city of Oswego, N. Y., over Oswego River at that city.—lans for reconstructing an existing bridge at this place were approved pril 15, 1909.

Bridge of the town of Eden, Me., over channel between Bar Harbor nd Bar Island.—Plans and map of location were approved April 21, 909.

Bridge of Carteret County, N. C., over North River in that county.—lans and map of location were approved April 21, 1909.

Bridge of Illinois Central Railroad Company over Salt River at West Point, Ky.—Plans for reconstructing an existing bridge at this place were approved April 27, 1909.

Bridge of the Peoria and Pekin Union Railway Company over Illinois River at Peoria, Ill.—Plans and map of location were approved April 29, 1909.

Bridge of the Linn Creek Bridge Company over Osage River near Linn Creek, Mo.—Plans and map of location were approved May 5, 1909.

Bridge of Margaret A. Hill over Hook Creek between the city of New York and Hempstead, N. Y.—Plans and map of location were approved May 6, 1909.

Bridge of Tillamook County, Oreg., over Tillamook River near mouth of Trask River.—Plans and map of location were approved May 14, 1909.

Bridge of Essex and Hudson counties, N. J., over Passaic River (Newark Plank Road Bridge).—Plans for reconstructing this bridge were approved May 18, 1909.

Bridge of Harry Churchill over Little Red River at Pangburn, Ark.—Plans and map of location were approved May 22, 1909.

Bridge of Bergen County, N. J., over Berry Creek at the Paterson Plank Road.—Plans and map of location were approved May 22, 1909.

Bridge of Catahoula Parish, La., over Little River at Jonesville.—Plans for rebuilding an existing structure at this place were approved May 29, 1909.

Bridge of the Southern Pacific Company over San Francisco Bay at Dumbarton Point, Cal.—Plans for this bridge were approved November 24, 1906. Modified plans were approved June 2, 1909.

Bridge of the Chicago and Northwestern Railway Company over Fox River (Little Lake Butte des Norts) at Neenah, Wis.—Plans for rebuilding this bridge were approved June 16, 1909.

Bridge of the Chicago and Northwestern Railway Company over Fox River at Neenah, Wis.—Plans for rebuilding this bridge were approved June 16, 1909.

Bridge of the Chicago and Northwestern Railway Company over Fox River at Menasha, Wis.—Plans for reconstruction of this bridge were approved June 16, 1909.

Bridge of Burlington County, N. J., over Rancocas River at Bridgeboro.—Plans for reconstruction of an existing bridge at this place were approved June 21, 1909.

Bridge of the Norfolk and Southern Railway Company over Albemarle Sound between Hornblower Point and Mackeys Creek, North Carolina.—Modified plans for this bridge were approved June 23, 1909.

Bridge of Galveston County, Tex., over West Galveston Bay at Galveston.—Modified plans for this bridge were approved June 23, 1909.

Bridge of San Joaquin County, Cal., over Mokelumne River at Benson Ferry.—Plans and map of location were approved June 23, 1909.

Bridge of the Louisa Coal Company over Levisa Fork of Big Sandy River at Torchlight, Ky.—Plans and map of location were approved June 25, 1909.

Bridge of Millers Creek Railroad Company over Levisa Fork of Big Sandy River near mouth of Millers Creek, Kentucky.—Plans and map of location were approved June 25, 1909.

Bridge of the city of Portland, Oreg., over Willamette River.—Plans for rebuilding this bridge were approved June 26, 1909.

Bridge of the village of Park Falls, Wis., over North Fork of Flambeau River.—Plans and map of location were approved June 28, 1909.

Bridge of the Louisville and Nashville Railroad Company over Salt River at Shepherdsville, Ky.—Plans for reconstructing an existing bridge at this place were approved June 30, 1909.

Bridge of the Colorado Southern, New Orleans and Pacific Railroad Company over Atchafalaya River below Melville, La.—Plans for altering an existing structure were approved June 30, 1909.

BRIDGES OBSTRUCTING NAVIGATION.

Under the requirements of section 18 of the river and harbor act approved March 3, 1899, the Secretary of War notified the persons, corporations, or associations owning or controlling certain bridges obstructing navigation, after giving them a reasonable opportunity to be heard, to so alter said bridges as to render navigation through or under them reasonably free, easy, and unobstructed, specifying in the notice the alterations required to be made and prescribing a reasonable time within which to make them, as follows:

Bridge of the Gulf, Colorado and Santa Fe Railway Company over Pine Island Bayou, near Beaumont, Tex.—Notice dated July 7, 1908, was served on the company July 16, 1908. Specified alterations to be completed on or before six months from date of service of notice.

Bridge of the Norfolk and Southern Railway Company over Lynnhaven Inlet, Virginia.—Notice dated July 8, 1908, was served on the company July 25, 1908. Specified alterations to be completed on or before three months from date of service of notice.

Bridge of Calhoun County, Fla., over Chipola River, near Clarksville, Fla.—Notice dated October 6, 1908, was served on the board of county commissioners on November 7, 1908. Specified alterations to be completed on or before twelve months from date of service of notice.

Bridge of the Charleston Bridge Company over Ashley River at Charleston, S. C.—Notice dated January 25, 1909, was served on the company February 5, 1909. Specified alterations to be completed on or before eight months from date of service of notice.

Bridge of Iberville Parish, La., over Bayou Plaquemine.—Notice dated March 5, 1909, to remove cofferdam around south pier was served on the police jury of said parish. Specified removal to be completed within thirty days from date of service of notice.

Bridge of Kent County, Del., over Leipsic River at Leipsic, Del.—Notice dated March 25, 1909, was served on the levy court of said county April 13, 1909. Specified alterations to be completed on or before September 1, 1909.

Bridge of King County, Wash., over Sammamish River (Squak Slough) below Bothel, Wash.—Notice dated March 25, 1909, was served on the board of county commissioners April 5, 1909. Specified alterations to be completed on or before October 1, 1909.

Bridge of the Atlantic Coast Line Railroad Company over Ashley River at Bees Ferry, S. C.—Notice dated March 30, 1909, was served on the company April 12, 1909. Specified alterations to be completed on or before six months from date of service of notice.

Bridge of Galveston and Harris counties, Tex., over Clear Creek, near League City, Tex.—Notices dated April 1, 1909, served on the commissioners' courts of these counties April 12 and 14, 1909. Specified alterations to be completed on or before June 1, 1909.

Bridge of Duval County, Fla., over Pablo Creek, in said county.—Notice dated April 21, 1909, was served on the board of county commissioners May 1, 1909. Specified alterations to be completed on or before four months from date of service of notice.

Bridge of counties of Charleston and Colleton, S. C., over Rantowles Creek, South Carolina.—Notices dated May 11, 1909, served on the county supervisors May 18, 1909. Specified alterations to be completed within four months from date of service of notices.

Bridge of Kent County, Del., over Leipsic River (Martins Bridge), in that county.—Notice dated May 19, 1909, was served on the levy court of said county June 8, 1909. Specified alterations to be completed on or before October 1, 1909.

Bridge of the city of Seattle, Wash., over Duwamish River West Waterway.—Notice dated May 19, 1909, was served on board of public works June 2, 1909. Specified alterations to be completed on or before October 31, 1909.

Bridge of the Northern Pacific Railway Company over the West Waterway of Duwamish River at Seattle, Wash.—Notice dated May 19, 1909, was served on the company June 1, 1909. Specified alterations to be completed on or before October 31, 1909.

Bridge of the Seattle Electric Company over waterways at entrance of Duwamish River at Seattle, Wash.—Notice dated May 19, 1909, was served on the company May 28, 1909. Specified alterations to be completed on or before October 31, 1909.

Bridge of the city of Chicago over North Branch of Chicago River at Indiana street.—Notice dated June 30, 1909, was served on the mayor July 20, 1909. Specified alterations to be completed on or before May 30, 1912.

Bridge of the city of Chicago, Ill., over entrance to South Branch of Chicago River at Lake street.—Notice dated June 30, 1909, was served on the mayor of the city July 20, 1909. Specified alterations to be completed on or before December 31, 1912.

STRUCTURES OTHER THAN BRIDGES IN THE NAVIGABLE WATERS OF THE UNITED STATES.

Pursuant to the provisions of sections 9 and 10 of the river and harbor act of March 3, 1899, and of certain special acts of Congress, numerous applications for permission to build structures of various kinds other than bridges (such as dams, wharves, dolphins, booms, weirs, etc.) in the navigable waters of the United States have been examined with a view to the protection of navigation interests.

Upon the recommendation of the Chief of Engineers, permits have been granted by the Secretary of War for the erection of a number of such structures, but specific reference is not deemed necessary except in the following cases.

Dam of Reuben Bollinger in Clinch River near Agee, Tenn.—Plans and map of location were approved January 19, 1909.

Dam of Spencer B. Newberry in Rock River at Grand Detour, Ill.—Construction of this dam was authorized by act of Congress approved February 16, 1906. Plans and map of location were approved February 4, 1909.

Dam of Twin City Power Company in Savannah River near Prices Island, South Carolina.—Construction of this dam was authorized by act of Congress approved February 28, 1908. Plans and map of location were approved February 20, 1909.

Dam of the Bedford Power Company across East Fork of White River at Williams, Ind.—Plans and map of location were approved February 27, 1909.

Dam of the Choctawhatchee River Light and Power Company in Choctawhatchee River near Newton, Ala.—Construction of this dam was authorized by act of Congress of March 10, 1908. Plans and map of location were approved March 9, 1909.

Dam of the Ruth Trust Company across Willamette Slough near Portland, Oreg.—Plans and map of location for a structure to replace one built by the United States were approved May 12, 1909.

MISCELLANEOUS.

[Public works not provided for in acts making appropriations for the construction, repair, and preservation of works on rivers and harbors.]

BRIDGES AT WASHINGTON, DISTRICT OF COLUMBIA.

Operations under this head were in the temporary charge of First Lieut. E. J. Dent, Corps of Engineers, to July 18, 1908, in the charge of Maj. Spencer Cosby, Corps of Engineers, from July 19, 1908, to December 22, 1908, and in the charge of Maj. Jay J. Morrow, Corps of Engineers, from December 23, 1908, to the end of the fiscal year, with the exception of the highway bridge across Potomac River, which was transferred to the office of Public Buildings and Grounds September 12, 1908, under authority of the Secretary of War dated September 1, 1908.

1. *Repair of the Aqueduct Bridge across Potomac River.*—(*a*) *Repair of piers.*—Congress by joint resolution approved July 1, 1902, enacted as follows:

> That the Secretary of War be, and he is hereby, authorized to spend an amount not exceeding three thousand dollars from the balance of appropriations made for the reconstruction of pier number four of the Aqueduct Bridge, District of Columbia, for the purpose of the examination of and immediate temporary repairs to the remaining piers of said bridge in cases of need arising from flood or ice.

The act of Congress approved March 2, 1907, making appropriations for the expenses of the government of the District of Columbia for the fiscal year ending June 30, 1908, contains the following item:

> And the unexpended balance, amounting to about fourteen thousand dollars, of the appropriations for the reconstruction of piers numbered four and five of said bridge is hereby reappropriated and made available for the periodical examination of the remaining piers of the bridge and making of such repairs as may be found necessary.

Examinations by diver and such minor repairs as were found necessary have been made from time to time. These examinations have shown that there is in process a gradual deterioration of the masonry of the piers below the water line. The defects show usually in the form of cavities caused by the dropping out, during freshets, of one or more of the stones in or near the face. These cavities have usually been repaired by filling them with concrete in bags, deposited by a diver. In some instances the repaired portions have been protected by placing riprap in front of them. In three of the piers, Nos. 1, 4, and 5, the defects became so serious that this method of repair was impracticable and new piers have been built to replace the old ones.

A thorough examination of all the old piers was made during September, 1908. A number of large cavities were found, which were repaired by filling them with concrete in the usual manner. During October, 1908, heavy riprap was placed in front of some of the largest of these patches and the piers were left in as good condition as practicable.

July 1, 1908, balance unexpended	$14,956.01
June 30, 1909, amount expended during fiscal year	1,276.08
July 1, 1909, balance unexpended	13,679.93

(*b*) *Pier No. 1.*—The District of Columbia appropriation act approved March 2, 1907, contains the following item:

> AQUEDUCT BRIDGE: For reconstruction of pier numbered one of the Aqueduct Bridge across the Potomac River at Georgetown, District of Columbia, to be expended under the direction of the Secretary of War, eighty thousand dollars.

An examination made in January, 1907, showed this pier to be in such condition that it was considered impracticable to repair it satisfactorily.

Plans and specifications for the complete removal of the pier and the construction of a new and stronger pier in its place were prepared and a contract for the work was entered into July 24, 1907. Work under the contract was begun August 15, 1907, when dredging around the pier was started. From about the first of September the work was carried on continuously, except for delays due to freshets and ice in the river during January and February, 1908, and to shortage of materials at other times. The cofferdam and the false work to support the superstructure of the bridge were finally completed in March, 1908, and the removal of the old pier was begun. This work was completed and the construction of the new pier commenced late in April. The new pier is founded on the solid rock bottom of the river and consists of a concrete base extending to about 7 feet below the water line, and of ashlar masonry with concrete backing above that elevation.

The masonry work was completed and the bridge trusses lowered to a bearing on the new pier in July, 1908. The removal of the cofferdam and puddling material and the final cleaning up were completed in August, 1908.

July 1, 1908, balance unexpended	$54,800.28
June 30, 1909, amount expended during fiscal year	40,122.50
July 1, 1909, balance unexpended	[a] 14,677.78

(See Appendix C C C 1.)

---

[a] Balance of $14,677.78 deposited in United States Treasury (reverted and dropped).

2. *Highway Bridge across Potomac River at Washington, D. C.*—(*a*) *Construction.*—All of the government work in connection with the construction of the highway bridge and approaches was completed during the fiscal year ending June 30, 1908. A complete history of the project will be found in the Annual Report of the Chief of Engineers for that and preceding years.

On September 12, 1908, the unexpended balance of the appropriation for construction, including the retained percentage on the contract for paving the approaches, which was held under a five-year guarantee clause, was turned over to the office of Public Buildings and Grounds, under authority of the Secretary of War, dated September 1, 1908.

July 1, 1908, balance unexpended	$4,832.24
September 12, 1908, amount expended	300.60
September 12, 1908, balance unexpended and turned over to the office of Public Buildings and Grounds	4,531.64

(*b*) *Maintenance and operation.*—In addition to the routine work of operating the draw and policing the bridge and approaches, the work of repairing and strengthening the timber fenders of the pivot and rest piers at the draw, commenced during the last fiscal year, was continued and minor repairs were made to portions of the machinery.

The bridge and approaches were transferred on September 12, 1908, to the office of Public Buildings and Grounds, under authority of the Secretary of War, dated September 1, 1908.

MAINTENANCE OF HIGHWAY BRIDGE ACROSS POTOMAC RIVER, DISTRICT OF COLUMBIA, 1908.

July 1, 1908, balance unexpended	$2,052.67
September 12, 1908, amount expended	2,032.44
September 12, 1908, balance unexpended, reverted to Treasury	20.23

MAINTENANCE OF HIGHWAY BRIDGE ACROSS POTOMAC RIVER, DISTRICT OF COLUMBIA, 1909.

Amount appropriated by act of May 26, 1908	$16,000.00
September 12, 1908, amount expended	2,499.11
September 12, 1908, balance unexpended and turned over to the office of Public Buildings and Grounds	13,500.89

(See Appendix C C C 2.)

MAINTENANCE AND REPAIR OF THE WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, AND WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT.

Operations under this head were in the charge of Capt. E. J. Dent, Corps of Engineers, to July 18, 1908; Maj. Spencer Cosby, Corps of Engineers, July 19, 1908, to December 22, 1908, and Maj. Jay J. Morrow, Corps of Engineers, from December 22, 1908, to the end of the fiscal year. The last two officers had under their immediate orders Capt. E. J. Dent, Corps of Engineers, from July 19, 1908, to December 31, 1908, and Lieut. Warren T. Hannum, Corps of Engineers, from November 17, 1908, to the end of the fiscal year.

1. *Washington Aqueduct, District of Columbia:* (*A*) *Maintenance and operation of the Washington Aqueduct and its accessories.*—Appropriations for maintenance and operation of the Washington Aque-

duct are applied to the improvement, maintenance, and repair of those parts of the water-supply system which are under the supervision of the Chief of Engineers. These are the masonry dam across the Potomac at Great Falls, the works there for regulating the supply to the conduit, the Conduit road from Great Falls to Washington, a distance of about 14 miles, the conduit from Great Falls to the Georgetown reservoir, a distance of about 12 miles, the three reservoirs for supplying the city, the tunnel, about 4 miles long, connecting the Georgetown and McMillan Park reservoirs, the two bridges for carrying the mains across Rock Creek, and other auxiliary works. A description of these works may be found in the Annual Report of the Chief of Engineers, 1903, pages 2485–2487.

The original project for construction of the Washington Aqueduct was dated February 12, 1853, and published as Senate Executive Document No. 48, Thirty-second Congress, second session. The project provided for supplying the city of Washington with water taken from the Potomac River at Great Falls, Maryland, about 14 miles above the city and 16½ miles from the present filtration plant, and with water from Little Falls Branch. Work was begun in 1853, and in 1859 water from Little Falls Branch was supplied to the city through the conduit. The first Potomac water was supplied to the city in December, 1863.

The water from Little Falls Branch became polluted and works for excluding it were completed in 1895. The dam at Great Falls was raised during 1896 and the capacity of the system increased to its present extreme limit of 90,000,000 gallons per day, or, making allowances for sudden increases in consumption, to a safe limit of 65,000,000 gallons. For a discussion of the capacity of the system, see Annual Reports, Chief of Engineers, for 1897, pages 3991–4014, and for 1906, pages 2093–2095, and Appendix D D D of this report.

During the year the conduit between Great Falls and Dalecarlia reservoir has been cleaned twice; the tunnel between Georgetown and McMillan Park reservoirs were partially drained and repaired; some repairs were made to the Conduit road; concrete wing walls were built for strengthening the masonry at the north connection of Dalecarlia reservoir, and the other structures were maintained in good condition.

WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, 1908—MAINTENANCE.

July 1, 1908, balance unexpended	$3,624.79
June 30, 1909, amount expended during fiscal year	3,581.59
July 1, 1909, balance unexpended	[a] 43.20

WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, 1909—MAINTENANCE.

Amount appropriated by act approved May 26, 1908	$33,000.00
June 30, 1909, amount expended during fiscal year	28,770.85
July 1, 1909, balance unexpended	4,229.15
July 1, 1909, outstanding liabilities	4,229.15

---

[a] Balance of $43.20 deposited in Treasury of the United States; reverted and dropped.

(*B*) *Purchase of dredge for Dalecarlia reservoir.*—The dredge was purchased under contract, and final payment was made in April, 1908.

July 1, 1909, balance unexpended	[a] $2,106.10

(*C*) *Increasing the water supply of Washington, D. C.*—By act of Congress approved May 26, 1908, $10,000 was appropriated for preliminary investigations and surveys for increasing the water supply.

The results of these investigations, with recommendations, were made the subject of a special report to the Chief of Engineers by the officer in charge, which report was submitted after the close of the fiscal year, on July 8, 1909. Summarized, the report finds no present necessity for construction of a new aqueduct, provided the measures for prevention of waste are completed as rapidly as can be economically accomplished. Recommendations are made for the completion within three years of the installation of meters in private services, for the metering within one year of all government services, and for the immediate construction of the coagulating plant, and remodeling of reservoir for use therewith, as previously recommended.

INCREASING WATER SUPPLY OF WASHINGTON, D. C.—PRELIMINARY INVESTIGATIONS AND SURVEYS.

Amount appropriated by act approved May 26, 1908	$10,000.00
June 30, 1909, amount expended during fiscal year	9,109.33
July 1, 1909, balance unexpended	890.67
July 1, 1909, outstanding liabilities	890.67

(*D*) *Dredging Dalecarlia reservoir.*—By act of Congress approved March 2, 1907, an appropriation of $16,000 was made for the removal, by dredging, of about 134,000 cubic yards of sediment from Dalecarlia reservoir.

As all of the dredging necessary could not be accomplished during the fiscal year 1908, Congress, by act approved May 26, 1908, provided that any unexpended balance under the appropriation for dredging should continue to be available for the fiscal year 1909.

The necessity for this dredging is explained on page 880, Annual Report of the Chief of Engineers for 1908.

Work under this appropriation, amounting to 110,590 cubic yards of dredging, was completed, 64,210 cubic yards of material having been dredged during the fiscal year 1909.

WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, 1908—DREDGING DALECARLIA RESERVOIR.

July 1, 1908, balance unexpended	$642.83
June 30, 1909, amount expended during fiscal year	642.83

WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, 1909.—DREDGING DALECARLIA RESERVOIR.

Amount reappropriated by act approved May 26, 1908	$10,872.09
June 30, 1909, amount expended during fiscal year	7,245.69
July 1, 1909, balance unexpended	3,626.40
July 1, 1909, outstanding liabilities	626.40
July 1, 1909, balance available	[b] 3,000.00

---

[a] In Treasury United States; reverted and dropped.

[b] Balance of $3,000 deposited in Treasury of the United States; reverted and dropped.

(*E*) *Riprapping sides of Dalecarlia reservoir.*—By act of Congress approved March 2, 1907, $18,000 was appropriated for riprapping the sides of Dalecarlia reservoir for a width of about 20 feet.

Work was begun in July, 1907. During the present fiscal year 2,234 cubic yards of paving stone were quarried, and 4,230 linear feet of slope paved for a width of 18 feet. Congress, by act approved May 26, 1908, provided that any unexpended balance under the appropriation for riprapping should continue to be available for the fiscal year 1909. The work under this act was completed in November, 1908.

WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, 1909.—RIPRAPPING SIDES OF DALECARLIA RESERVOIR.

Amount reappropriated by act approved May 26, 1908	$4,890.69
June 30, 1909, amount expended during fiscal year	4,890.69

(*F*) The necessity for completing the aqueduct system, including the filtration plant, by the construction of works for preliminary treatment of the water was discussed in the Annual Report of the Chief of Engineers for 1908, pages 2365 to 2372. This necessity still exists, and an estimate has been submitted for building this work.

(*G*) In the spring of 1909 the Metropolitan Southern Railroad began the construction of a railroad over the right of way through the grounds of the Dalecarlia reservoir, granted by act of Congress approved March 3, 1891. The regulations approved by the Secretary of War in 1893 to govern the construction and maintenance of the railroad, as published on page 4288, Annual Report of the Chief of Engineers for 1893, were slightly amended in 1909 to meet present conditions. The construction is being prosecuted in accordance with these regulations under the supervision of the engineer officer in charge of the Washington Aqueduct.

As required by the regulations, the railroad company deposited with the Treasurer of the United States $1,500, from which the cost of necessary inspection of the railroad construction is being paid.

Deposited by railroad company	$1,500
June 30, 1909, amount expended during fiscal year	35
July 1, 1909, balance unexpended	1,465

The estimates for the fiscal year ending June 30, 1911, are as follows:

For operation, including salaries of all necessary employees, maintenance, and repair of the Washington Aqueduct and its accessories, including Conduit road, the McMillan Park reservoir, and the Washington Aqueduct tunnel, and also including the purchase and maintenance of a motor truck, horses, vehicles, and harness, and the care and maintenance of the stable	$33,000
For remodeling the storehouse and stable at Great Falls	2,500
For emergency fund, to be used only in case of a serious break requiring immediate repairs in one of the important aqueduct or filtration-plant structures, such as a dam, conduit, tunnel, bridge, building, or important piece of machinery, all expenditures from this appropriation to be reported in detail to Congress	5,000
For continuation of parking grounds around McMillan Park reservoir, formerly known as Washington City reservoir	10,000
For remodeling the Georgetown reservoir and constructing works to provide for the preliminary treatment of Potomac water by means of a coagulant, and for each and every purpose connected therewith, to be available until expended	130,000

For the purchase, installation, and maintenance of water meters to be placed on all services to United States buildings, reservations, or grounds, said meters to be purchased, installed, maintained, and remain under the observation of the officer in charge of the Washington Aqueduct	$50,000

(See Appendix D D D 1.)

2. *Washington Aqueduct, District of Columbia, Filtration Plant:* (*A*) *Construction.*—By act of Congress approved June 6, 1900, the sum of $2,000,000 was appropriated—

> For establishing those portions of a filtration plant which are essential to the operation of either system of filtration adopted * * *.

By act of Congress approved March 1, 1901, the sum of $500,000 was appropriated—

> Toward establishing a slow filtration plant * * *.

By these and subsequent acts of Congress there has been appropriated for this work a total sum of $3,468,405.

A description of the Washington Filtration Plant is given on pages 2101 to 2103, Annual Report of the Chief of Engineers, U. S. Army, 1906.

At the beginning of the fiscal year the work had been practically completed. An experimental filtration plant, for studying the efficiency of slow-sand filters when operated at various rates, was installed during the year.

Final payment was made August 13, 1908, to Henry R. Worthington for the main pumping engines upon final test and acceptance, thus completing the contract.

No contract is now in force and the balance of the appropriation stated below has been covered into the Treasury by the sundry civil act approved March 4, 1909.

WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT—CONSTRUCTION.

July 1, 1908, balance unexpended	$53,990.73
June 30, 1909, amount expended during fiscal year	12,891.94
July 1, 1909, balance unexpended	41,098.79
July 1, 1909, balance available	41,098.79

Washington Aqueduct, District of Columbia, Filtration Plant: (*B*) *Maintenance and operation.*—By act of Congress approved May 26, 1908, the sum of $82,000 was appropriated for maintenance and operation of the Washington Aqueduct, District of Columbia, Filtration Plant for the fiscal year 1909.

The Washington Filtration Plant consists of a pumping station for raising the water from the McMillan Park reservoir to the filters; of 29 filter beds of the slow-sand type, having an effective filter area of 1 acre each; of a filtered-water reservoir, having a capacity of about 15,000,000 gallons; of the necessary piping and valves for carrying the water, controlling the rates of filtration, etc., of a sand-washing and storage system, and of a laboratory for testing the water. The filtration plant has been in continuous operation throughout the year and the entire water supply of the city has been filtered. The bacteria have been reduced from an average of 389 per cubic centimeter in the McMillan Park reservoir to an average of 21 in the filtered-water reservoir. The average turbidity has been similarly reduced from 22 to 1 part per million. The actual number of bacteria in the city water varied from 160 to 2 per cubic centimeter, while the number in the river water ran from 90,000 to 38. The actual average reduction by months varied between 99.7 and 97 per cent.

The work during the year consisted in cleaning and operating the filters; in analyzing samples of water from the several reservoirs, from each filter, and from taps in various parts of the city; in operating and keeping in repair the pumping station; in doing the necessary clerical work connected with the office; and in conducting experiments with a view to determining the results of different rates of filtration. All work was done by day labor.

The total quantity of water pumped to the filters during the year was 22,435.16 million gallons, or an average of 61.47 million gallons per day. During the year 24,683 cubic yards of sand were washed and 23,487 cubic yards were replaced in the filters. While the quality of the city filtered water was excellent for the greater part of the year, there were several periods when the number of bacteria exceeded what is considered by experts to be the proper standard for a filtered water supply. The filtered water was unsatisfactory with respect to turbidity for a considerable percentage of the time. This confirms the experience of the three previous fiscal years and also the judgment of the three experts as expressed in their report, dated February 18, 1901, to the chairman of the Senate Committee on the District of Columbia.

The cost per million gallons filtered was $3.66.

A more complete description of the Washington Filtration Plant may be seen in the Annual Report of the Chief of Engineers for 1906, pages 2101 and 2102.

Attention is invited to that portion of the report of the officer in charge for the fiscal year 1908 appearing on pages 2365–2372, Annual Report of the Chief of Engineers for 1908, which deals with the subject of preliminary treatment of Potomac water.

In order that the city of Washington may at all times be supplied with a water that is unexceptional both in quality and appearance, it is recommended that works for preliminary coagulation be constructed, and estimates for this improvement are submitted.

The following estimate for the maintenance and operation of the Washington Aqueduct, District of Columbia, Filtration Plant for the year ending June 30, 1911, is submitted:

For care, including salaries of all necessary employees, maintenance, and operation of the Washington Aqueduct, District of Columbia, Filtration Plant, and for each and every purpose connected therewith	$86,000
For the purchase of coagulant, estimated one year's supply	9,000
Total	95,000

MAINTENANCE, WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT, 1908.

July 1, 1908, balance unexpended	[a] $11,369.34
June 30, 1909, amount expended during fiscal year	9,476.73
July 1, 1909, balance unexpended	[b] 1,892.61

---

[a] Six thousand dollars of the available balance under this head July 1, 1908, carried to maintenance, Washington Aqueduct, District of Columbia, Filtration Plant, 1909.—Parking grounds, Washington City reservoir.

[b] Balance of $1,892.61 deposited in United States Treasury; reverted and dropped.

MAINTENANCE, WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT, 1909.—GENERAL.

Amount appropriated by act approved May 26, 1908	$82,000.00
June 30, 1909, amount expended during fiscal year	71,998.56
July 1, 1909, balance unexpended	10,001.44
July 1, 1909, outstanding liabilities	10,001.44

(*C*) *Parking grounds, Washington City reservoir.*—By act of Congress approved May 26, 1908, the sum of $6,000 was reappropriated from the amount appropriated for the maintenance and operation of the Washington Aqueduct, District of Columbia, Filtration Plant for the fiscal year ending June 30, 1908.

During the fiscal year 1909 the slope on the west side of First street NW., between Bryant and Douglas streets, was graded and sodded, and the work of grading the rough areas south of the dam and on the west side of the reservoir was nearly completed. The ground has no covering of soil and will not support a growth of either grass or shrubs. It will, therefore, be unsightly in appearance until it is covered with soil and the work of parking has been completed, as described in the report of the officer in charge.

It is recommended that an appropriation be made for continuing this work, for which is submitted estimate under the general heading of the Washington Aqueduct.

WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, 1908.—PARKING GROUNDS, WASHINGTON CITY RESERVOIR.

July 1, 1908, balance unexpended	$273.79
June 30, 1909, amount expended during fiscal year	273.79

WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT, 1909.—PARKING GROUNDS, WASHINGTON CITY RESERVOIR.

Amount reappropriated by act approved May 26, 1908	$6,000.00
June 30, 1909, amount expended during fiscal year	5,527.92
July 1, 1909, balance unexpended	472.08
July 1, 1909, outstanding liabilities	472.08

(See Appendix D D D 2).

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS, AND CARE AND MAINTENANCE OF THE WASHINGTON MONUMENT AND OF THE HIGHWAY BRIDGE ACROSS THE POTOMAC RIVER, WASHINGTON, DISTRICT OF COLUMBIA.

Officers in charge: Col. Chas. S. Bromwell, U. S. Army, major, Corps of Engineers, to March 16, 1909. Since that date Col. Spencer Cosby, U. S. Army.

Miscellaneous repairs were made in and about the Executive Mansion, including considerable painting in the interior. The furniture was regularly cared for. Repairs were also made to the Executive Office building, to the President's stable, and to the greenhouse structures and their heating apparatus.

The care required to maintain them in good condition was extended to the improved parks and small reservations. Three additional park spaces were transferred to the Chief of Engineers by the Commissioners of the District of Columbia, and one reservation was transferred to the commissioners for street purposes. Two unimproved reservations were improved. A macadam driveway was constructed along north B street on the northern boundary of Potomac Park between Virginia avenue and Twenty-first street, west, and land in squares 63 and 89 was acquired by condemnation for continuing the driveway through these squares. The river drive between the inlet and Twenty-sixth street was completed by constructing the portion from Easbys Point to Twenty-sixth street. Three thousand two hundred and twenty-six feet of cement coping were constructed around six reservations, and 2,664 square yards of asphalt footwalk and 130 square yards of asphalt roadway were resurfaced. Some of the macadam roadways in Potomac Park were treated with oil. Work was commenced for lowering to street grade the main carriage road formerly carried from Henry Park to Seaton Park over the bridge across the railroad tracks on Sixth street. The temporary use of the north half of reservation 113 by the Commissioners of the District of Columbia for railroad purposes was relinquished and the ground reimproved.

At the Washington Monument a new cable was placed on the elevator car, the wooden sheathing on the walls of the motor room was replaced with glazed tile, and the engine in the power house was overhauled and repaired.

At the propagating gardens the various greenhouse structures were repaired as far as funds would admit. Nearly 690,000 plants were propagated, of which about 649,000 were planted in the parks and reservations.

Two hundred and twenty-eight park settees were repaired and 1,110 painted; 1,048 cubic yards of stable manure were used upon lawns and for mulching shrubbery and young trees. Iron post and chain fences were erected around six reservations, and those around two others were replaced by cement coping; 4,637 feet of water pipe and 2,523 feet of drain pipe were laid.

Inspections were made each month of the buildings occupied as offices by the War Department, except State, War, and Navy Department building, so far as their preservation, care, and safety were concerned.

The old station building of the Pennsylvania Railroad Company at Sixth and B streets NW., which was transferred to the War Department by that company, was torn down and the material removed.

A portion of the old overhead wires of the departmental telegraph line were replaced by underground cable.

Repairs were made to the fender system of the highway bridge across the Potomac River, District of Columbia, and portions of the ironwork above the deck of the bridge were painted.

The statues of Gen. Philip H. Sheridan, Henry Wadsworth Longfellow, and John Witherspoon, and the Stephenson Grand Army memorial were erected and completed, and all but the latter unveiled. The architectural portion and some of the bronze sculpture of the Grant memorial were finished. A site was selected for the statue of Commodore John Barry, and models were submitted in a competition for that statue; a new site was selected and contract entered into for the statue of John Paul Jones; and progress was made on the models for the Pulaski and the Von Steuben statues.

Attention is invited to the detailed report of the officer in charge and to his estimates and recommendations for the fiscal year ending June 30, 1910.

The estimates are as follows:

For the improvement and care of public buildings and grounds in charge of the Chief of Engineers		$398,870
For compensations of persons employed by office of Public Buildings and Grounds		88,150
Telegraph lines connecting Capitol with Departments; care and repair of existing lines		1,000
For contingent and incidental expenses of public buildings and grounds		1,100
For care of Washington Monument and maintenance of elevator:		
Salaries of employees	$8,820	
Fuel, lights, contingencies, etc	3,000	
		11,820
For completing work for the erection of the memorial to Gen. Ulysses S. Grant		83,000
For maintenance of highway bridge across Potomac River, District of Columbia		16,000
For monument and wharf at Wakefield, Va., the birthplace of Washington: Repairs to wharf and cleaning up grounds, etc		7,100
Total		607,040

(See Appendix E E E.)

NORTHERN AND NORTHWESTERN LAKES—CORRECTING AND ISSUING CHARTS—SURVEYS—WATER LEVELS—PRESERVATION OF NIAGARA FALLS.

As early as 1816 local surveys of the Great Lakes for special purposes were made by engineer officers, but the "Lake Survey" as a systematic work was commenced in 1841. It was diligently prosecuted thereafter until 1882, when for a time extended field operations were suspended. The correction, printing, sale and issue of charts continued without cessation, however, the additions and corrections being largely based upon local surveys and reports by engineer officers in charge of the river and harbor improvements on the lakes.

Systematic fieldwork was resumed in 1889, and has since been prosecuted with increased vigor. In 1898 operations were extended to include cognate work of observing and investigating the levels of the Great Lakes and their connecting waters, with a view to their regulation in the interest of commerce. The survey proper has from the beginning been carried on under the War Department, being at first conducted by the Chief of Topographical Engineers, and by the Chief of Engineers after the consolidation of the Topographical Engineers with the Corps of Engineers.

The first regular appropriation for the Lake Survey was made in 1841, and annual appropriations followed with the single exception of 1847. The appropriations to date for all purposes of the Survey during the sixty-eight years of its existence aggregate $4,311,879, of which $2,411.81 has reverted to the Treasury.

A full account of the operations of the Lake Survey from May, 1841, to July 1, 1881, is contained in Professional Papers, Corps of Engineers, U. S. Army, No. 24, which describes in detail the methods of primary triangulation employed. The condition of lake navigation in 1841 is shown by the following extract:

> The Lake Survey was begun in 1841 under an appropriation of $15,000 made in May of that year. At this time the country bordering on the lower lakes was already pretty

well settled, and works for the improvement or formation of harbors had been commenced at most of the important points on Lakes Erie and Ontario. The upper lake region was but thinly settled, and there were no good harbors on Lake Huron and but one (the harbor of Chicago) on Lake Michigan. Settlers were, however, pouring in rapidly, and there was even then a large and constantly increasing commerce between the lake ports, especially from Buffalo to Detroit and Chicago. Communication with Lake Superior could only be had by portage around the Sault Ste. Marie, but the great mineral wealth of the country was attracting attention, and a survey for a ship canal had been made in 1840 by officers of the Topographical Engineers. The lake commerce was carried on under many difficulties, which caused much loss of life and property each year.

There were no charts of the lakes except the Admiralty charts, compiled from the surveys of Capt. H. W. Bayfield, of the royal navy (English), and these were not in general use by the masters of American vessels. These charts were the results of rapid reconnaissances, and although they showed the coast lines with an accuracy which is remarkable considering the rough methods of surveying employed, they were of little value as hydrographical charts of the American coast, because they showed the depths of water in comparatively few places and but a small number of the many reefs and shoals which are found along the lake shores.

There were few light-houses and beacons to indicate the positions of dangers to navigation, and, in the absence of charts, pilots were obliged to rely upon their own knowledge, which was frequently only acquired by the vessels grounding on a shoal or striking a hidden rock.

The navigation of the lakes is attended with peculiar dangers, because, while violent gales are frequent and the storms rival those of the ocean itself, a vessel is never more than a few hours' run from the shore, and can not, as is generally the case at sea, drift before the wind until the storm is over, but in a long-continued gale must be thrown upon the shore, unless a port or harbor of refuge can be entered. In 1841 a vessel leaving Chicago found no harbor or shelter in storms until the Manitou or Beaver islands were reached, and after passing the Straits of Mackinac it was again exposed without refuge on Lake Huron, except in the vicinity of Presque Isle, until the head of St. Clair River was reached. In sailing from Chicago to Buffalo the greatest difficulties were encountered in the vicinity of the Straits of Mackinac and in the west end of Lake Erie on account of the many islands, shoals, and reefs found in those localities, and at the mouth of the St. Clair River, at which no improvements had been made in 1841, and where the channels were not only circuitous and narrow, but so shoal that vessels in low-water seasons frequently were compelled to have their cargoes taken over the bars in lighters.

It was therefore with the double object of furnishing reliable charts to lake vessels and of determining from the surveys the works of improvement which were necessary to the prosperity of the lake commerce that Congress in 1841 directed a survey of the lakes, and that annual appropriations, with the single exception of the year 1847, have since been made for carrying on the survey.

During the first ten years of the Survey, while a general geodetic survey of the entire chain of lakes was contemplated for the future, the actual operations were mainly confined to surveys of special localities where improvements were called for or where the navigation was difficult; and where the surveys were more extended they were little more than reconnaissances. This course was made necessary because the appropriations were inadequate to the purchase of the finer instruments and the support of the larger force necessary for more extensive and more exact surveys, and also because of the pressing need of improvements at particular localities, for which preliminary surveys were essential.

Originally the Lake Survey seems to have operated under projects which implied the survey of the Great Lakes and their connecting waters to the extent necessary for the preparation of charts needed by a navigation whose greatest draft was 12 feet. With the increase in vessel dimensions has naturally followed the creation of channels and harbors with progressively greater depths, and the Lake Survey, under projects providing for the expenditure of annual appropriations, has kept pace with the improvements in navigation and in navigational facilities by a corresponding extension of the scope of its operations.

It is difficult to indicate the exact moment of transition from the original projects which, as stated, provided for surveys and their resulting charts adapted to a 12-foot navigation, to the recent projects which correspond to present-day drafts of 18 to 20 feet; but, in a general way, it may be said that the limitations imposed upon navigation by the conditions at the falls of the St. Marys River have seemed to fix the scope of the operations of the Lake Survey in the open lakes and in the connecting rivers, while local projects for improvement have prescribed the limits of the survey work in lake harbors. The work of the Lake Survey has been continuous, and while a general project for the future work has now been authorized, all expenditures upon work done before the adoption of this project may justly be regarded as contributing to its fulfillment. In other words, none of the work of the past has been rendered futile by the changed conditions of the present. On the contrary, the methods of the old Lake Survey, and the high standards of accuracy and excellence which then prevailed, have continued to characterize its present policy and operations; and the work of to-day extends the former work to limits which were not anticipated by the most sanguine spirits of former days.

The present general project of the Lake Survey is stated in much detail in the Annual Report for 1907, pages 844 to 850. This describes the work regarded as necessary in order to render the surveys and the charts of the Lake Survey adequate to respond to all possible future demands. This general project proposes the ascertainment and charting of lake depths in all significant regions of the Great Lakes to a plane 30 feet below the adopted low-water datum of the open lakes and 25 feet below the corresponding datum in the channels of the connecting rivers, together with the completion of the related operations of triangulation and precise leveling still needed to control properly the areas under survey. In addition, this general project provides for the extension of river-discharge measurements, for investigations of lake levels, and for magnetic surveys in and near main vessel courses, while prompt examination of areas where obstructions to navigation have been reported will be continued as heretofore.

Assuming that adequate appropriations will be provided, it is estimated that the completion of the above general project will, including the work of 1909, require ten seasons' work; but, even after the completion of this work, the maintenance of a reduced plant and organization will be required for such small surveys as may be needed to observe and verify natural changes and to investigate wrecks and other artificial obstructions, while the revision and issue of charts is a work absolutely without definite conclusion.

The amount expended on all surveys made since its inception by the Lake Survey may with propriety be regarded as the expenditure under the present project. This amount is $4,172,661.77.*

Assuming that the field work of the Lake Survey includes operations of triangulation, precise leveling, ordinary sounding, deep-sea sounding, sweeping, hydraulic measurement, and magnetic observations, whose extent may with some certainty be fixed, on June 30, 1909, the state of the work was as follows: Triangulation was 76 per cent completed; precise leveling, 64 per cent completed; ordinary sounding, 51 per cent; deep-sea sounding, 15 per cent; sweeping, 15 per cent; hydraulic measurement, 83 per cent; and magnetic observations, 90 per cent completed on land and 2 per cent on water.

---

*Amount stated in last paragraph on page 889, Annual Report of the Chief of Engineers, 1908, is in error.

While these figures may be definitely given, the remaining and most highly important function of the Lake Survey, namely, the issue of charts, as previously stated, is continuing. In fact, each year, with its increasing commerce, will increase the demand for and the importance of these charts.

At the beginning of the fiscal year three parties were in the field as follows: The first party was engaged in sounding and sweeping at the south end of Lake Michigan, the area which it was intended to cover being that south of the parallel of latitude through Gross Point, Ill. This important area, known in a general way to contain uncharted shoals, has recently become of increasing consequence because of the great development of the steel industry, not only at South Chicago, but also at Indiana Harbor and at the newly built harbor of Gary. The work of the party was successful in the highest degree. Between July 1 and October 30, 1908, an area of 152½ square miles was covered, of which 134 square miles was swept. Seventeen uncharted shoals having depths at standard low water datum of less than 18 feet were found, many of them directly in or very close to the vessel courses to Indiana and Gary harbors. These shoals were found to extend 5 miles northeast from Indiana Harbor. These discoveries, being of a capital character, were at once made the subject-matter of a special press notice and of an inset chart in Supplement No. 3 to Bulletin No. 18. In addition, two wrecks—those of the schooner *David Dows* and of the *Car-ferry Barge No. 2*—were later discovered in the same area. Each had a draft of 18½ feet at standard low water over it, and both were therefore regarded as menacing to navigation and were subsequently removed by the United States Engineer Office at Chicago. Despite a season rendered peculiarly unfavorable by the smoke of forest fires, which were at their worst during September and October, this party covered a large area with great thoroughness. It is especially notable that a single day's work with the wire sweep covered 5.3 square miles, and that after July 1 a total of 134 square miles was swept to a depth of 30 feet where not limited by bottom. All obstructions found were charted so that this most important area is now known with certainty.

The second party was at the beginning of the year engaged in sounding and sweeping in the Manitou Passage, the shoal which was the special object of investigation being that upon which the steamer *Gary* was damaged during the summer of 1907. Early in July this shoal was found and was discovered to be a bowlder ridge immediately in the vessel track, with a least depth of 17.3 feet at standard low water. No other discoveries of importance resulted from the work in the Manitou Passage, which was concluded on July 24, a total area of 11.28 square miles having been sounded and swept after July 1. At the conclusion of this work the party resumed the resurvey in the Straits of Mackinac, which during the previous year had been extended from Manitou Paymen shoal through the South channel well to the eastward of Cheboygan. This party was greatly hindered by forest fires, which made it difficult to see the signals established for the control of the hydrographic work. Up to November 8, 1908, when operations were closed, the sounding and sweeping were completed practically to Nine Mile Point, the area sounded embracing 81.61 square miles, of which 40.86 square miles were also swept.

On July 16, 1908, a party took the field for the purpose of extending the primary triangulation of the Lake Survey from the south side of Saginaw Bay to the southward with the incidental secondary and tertiary triangulation needed to establish upon the shore of Lake Huron the control needed for its resurvey. Up to December 23, 1908, when operations were discontinued, nine primary stations had been occupied and the angles fully read. The subordinate work had been extended to the neighborhood of Sherman, just south of Harbor Beach, Mich., and everything was in condition for the rapid extension of the work to the southward.

On August 28, 1908, a party which had been engaged upon hydraulic work on the Niagara River under an allotment from the act of June 29, 1906, left Buffalo for the St. Lawrence River, where, in view of the unusually high stage of Lake Ontario, an opportunity not hitherto available existed for extending the range of the observations of 1900 and 1901. Between September 21 and October 2, 26 separate discharge measurements were made at stages which for the highest are about one foot above the previous observations. In all the Lake Survey has now made 122 separate discharge measurements covering stages on the Oswego gauge between 243.7 and 247.3.

Upon the completion of this work the party returned to Buffalo, and after completing certain unfinished work in connection with the Niagara River observations, proceeded to Detroit, where it arrived on October 28. From October 29 to December 20 the party was employed in hydraulic work on the St. Clair River, at and near Port Huron, whose object was, primarily, an inquiry into the permanence of certain cross sections of the river which had been measured and monumented in 1898 and 1899. In addition, discharge measurements were made at the cross section (dry dock) used in the previous hydraulic work upon this river, and also at a new cross section (gorge) selected by this party with a view of comparing the results with those at section dry dock. The observations disclosed no measurable change in the critical reach at the head of the river, and 22 measured discharges in the new section gave results within from 1 to 2 per cent of those derived from the equations deduced from the former hydraulic work at section dry dock. In all 37 discharges were measured, and, within its limits, the work of this party serves to prove that the river is stable and the law of its flow well determined.

During the present field season, five parties have taken the field one of which has, at Niagara Falls, engaged in work described in a subsequent part of this report.

The first party has resumed the resurvey of the south end of Lake Michigan. It is now engaged in sweeping in a difficult region close to the Chicago breakwaters. Progress has therefore been somewhat retarded. Up to June 30, 1909, in about one month of field work, 16½ square miles were swept. A number of uncharted obstructions off the harbor were discovered, and, as soon as their locations had been definitely reported, their detailed description was published in press notices and in a special bulletin.

The second party has continued the resurvey of the Straits of Mackinac and has in addition made an investigation of an obstruction reported to have been struck by the steamers *Chicago* and *Ogdensburg*, in the Grays Reef Passage near Middle shoal. No obstruction was found at the reported locality and the chart is believed to be entirely accurate. Up to June 30, 1909, this party has occupied three stations of the system of water triangulation, taken topography over 5½ miles of shore line, and sounded 29.2 square miles, of which 7.8 square miles were also swept. Work is now in progress east of Nine Mile Point.

On June 10, 1909, a third party took the field for the purpose of extending southward, between the Bass and Sister islands, the resurvey of the west end of Lake Erie, which had been temporarily suspended in 1907. Up to June 30, 1909, this party had swept 26.5 square miles immediately adjoining the work of 1907, to a depth of 28.5 feet.

The fourth party has since April 12, 1909, been engaged in extending to the south the primary triangulation which had been discontinued late in December, 1908. Up to the close of the fiscal year the angles at three stations had been fully read, four new primary stations erected on the American side, three on the Canadian side, three primary stations dismantled, and ten secondary stations erected. The work is well under way and should be completed in September.

The execution of the survey which terminated in 1882 involved a great quantity of astronomic, topographic, and hydrographic work, all of which was performed with a high degree of accuracy and skill. The result was the preparation of a series of reliable charts for lake vessels and the furnishing of a basis for works of channel improvement upon the lakes themselves, and their connecting waters. This original series consisted of 76 charts, all of which were printed in black from copperplates.

The extensive revision of the charts now under way has for its object to show to date the changes, due to natural and artificial agencies, which have taken place in the formerly existing conditions as charted, and to furnish the additional information concerning the greater depth which the present requirements of commerce demand.

As a result of revisions, cancellations, and additions to the original series, based on the later surveys, there are now in force 123 Lake Survey charts, of which one is in black from old copperplate, 73 are lithographs in colors from copperplate transfers, 47 are lithographs in colors from stone engravings, and 2 are photolithographs in colors.

The charts issued in colors have all depths of 18 or 21 feet and less in blue, showing at a glance where vessels may proceed with safety, and are considered by vessel men much preferable to the old style printed in plain black and white. This new series of colored charts is believed to constitute a distinct advance in chart construction and printing, and meets with high favor from navigators and others.

During the year the Detroit office has revised, transferred to stone, and printed editions in colors from 14 copperplates, revised and printed second editions in colors from 6 engravings on stone, and engraved on stone and issued in colors 10 entirely new charts of the regular series. For free supplemental issue 6 insets were prepared by correction of and transfer from existing engravings. For other government offices 23 maps and drawings were reproduced by photolithography, new engravings, or transfers from engravings furnished. In addition to the above, revisions of 7 copperplate charts and engravings on stone of 5 new charts of the regular series are almost completed.

Of the entire series of charts there had been issued in colors, 5 on July 1, 1900; 12 on July 1, 1901; 30 on July 1, 1902; 49 on July 1, 1903; 59 on July 1, 1904; 73 on July 1, 1905; 97 on July 1, 1906; 110 on July 1, 1907; 117 on July 1, 1908; and 122 on July 1, 1909.

Upon April 17, 1909, a project was approved covering definitely the future chart work of the Lake Survey. In addition to providing for the preparation of 26 new charts, this project covers the revision of 39 old ones, so that thereafter all charts will be projected upon the geodetic datum adopted in 1901, with soundings referred to the planes of standard low water approved on March 16, 1909. The project also provides for the discontinuance of 21 charts, regarded as obsolete, and for publishing 31 of the less important harbor charts as insets to the appropriate coast charts. With the termination of this project, which is expected to require about six years, except for necessary revisions and new editions, the publication of the series of Lake Survey charts will have been completed, and, due to changes and omissions already described, will then include 104 separate charts.

Up to February 20, 1890, one full set of charts was issued free to each United States registered vessel. Any additional charts furnished such vessels and all furnished for other unofficial use were sold at the uniform price of 30 cents each. On the date above mentioned the free issue, except for official purposes of the Government, was discontinued pursuant to law, and since then the charts have been sold for all private and unofficial use at prices ranging from 5 cents to 30 cents each, the price being intended in each instance to cover only the cost of paper and printing.

Charts may be purchased at the main office at Detroit, at the canal office at Sault Ste. Marie, Mich., and at the United States engineer office in Buffalo. Complete sample sets may be seen at the United States engineer offices at Duluth, Milwaukee, Chicago, Grand Rapids, Cleveland, and Oswego, enabling purchasers to select exactly the charts they wish to order.

From 1882 to June 30, 1909, a total sum of $35,003.11 was derived from the sale of charts at offices where they were sold and deposited in the United States Treasury.

During the fiscal year ending June 30, 1909, the number of charts sold by the Detroit office was 14,048, and by the Buffalo office 3,128, the aggregate sales being 17,176. The proceeds of the sales, amounting to $2,686.05, were deposited to the credit of the Treasurer of the United States. The Detroit office issued 3,229 charts for official use and the Buffalo office 95, a total of 3,324. To date about 382,500 of these charts have been sold and issued for actual service.

In addition to the field work above mentioned and to that upon the charts, operations were continued under the present general project for the exhaustive investigation of lake levels, this being in continuation and extension of the project described in the Annual Report for 1898, pages 3774–3776. The principal field work of the year comprised lake-temperature observations and the maintenance of 12 self-registering water gauges to supply an accurate, continuous record of all changes in elevation of the water surface. Appendix F F F 1 of this report gives a table of discharges of all the Great

Lakes at the mean stage of each for the past forty-nine years, as determined from the monthly means shown on the plate in the same appendix. This work is now fully organized, methods of making measurements and observations to the best advantage have become fixed and settled, and the results are of increasing importance, bearing as they do on questions affecting international relations and obligations, and on the propriety and advisability of the numerous diversions under consideration.

The preparation and issue of the series of bulletins, supplementary to the charts, relating to the river and harbor improvements and navigation of the Great Lakes was begun by this office in 1889, and was transferred to the office of the Lake Survey, at Detroit, in 1902. Of Bulletin No. 18, issued in April, 1908, and remaining current for 1909, about 2,700 copies (from an edition of 3,000) have been distributed to the marine interests, and requests for it are constantly being received. These bulletins are revised biennially, with monthly supplements during each season of navigation, and give the latest and fullest descriptions of progress in river and harbor improvements on the Great Lakes and their connecting waters, as well as significant results of surveys in those waters made under the direction of district engineer officers and of the Lake Survey. If deemed helpful, small maps showing location of new shoals, changes in important channels, localities hitherto uncharted, etc., are inserted in both bulletins and supplements.

The commerce affected by the operations of the Lake Survey and depending upon the publication and constant revision of charts and bulletins is practically the entire commerce of the Great Lakes. To continue field and office operations at a rate commensurate with the importance of the interests involved requires that appropriations shall be of such amount as to permit the use of the entire plant to its maximum capacity during the relatively short seasons available for profitable work. It is therefore recommended that an appropriation of $125,000 be made for the fiscal year ending June 30, 1911, and that it be formulated as follows:

ESTIMATE FOR THE FISCAL YEAR ENDING JUNE 30, 1911.

For survey of northern and northwestern lakes, including all necessary expenses for preparing, correcting, extending, printing, and issuing charts and bulletins, and of investigating lake levels with a view to their regulation, to be immediately available and to remain available until expended, one hundred and twenty-five thousand dollars.

July 1, 1908, balance unexpended		$129,953.79
Amount appropriated by sundry civil act of March 4, 1909		125,000.00
Collections credited to account:		
Work for account of preservation of Niagara Falls	$2,008.73	
Damage to gauge	15.00	
Refundment, account of overpayments	13.34	
Work done for other engineer districts	2,613.23	
		4,650.30
		259,604.09
June 30, 1909, amount expended during fiscal year:		
At United States Lake Survey office, Detroit	122,761.82	
At Office of the Chief of Engineers	36.85	
		122,798.67
July 1, 1909, balance unexpended		136,805.42

A table showing the monthly water levels from July 1, 1907, to June 30, 1909, at Marquette, Mich., on Lake Superior; Milwaukee, Wis., on Lake Michigan; Harbor Beach, Mich., on Lake Huron; Cleveland, Ohio, on Lake Erie; and Oswego, N. Y., on Lake Ontario, will be found in Appendix F F F 1.

(See Appendix F F F 1.)

THE CONTROL AND REGULATION OF THE WATERS OF NIAGARA RIVER AND THE PRESERVATION OF NIAGARA FALLS.

The approved projects of operations under the various allotments from the appropriation made by the act of Congress of June 29, 1906, had for their purpose the determination of the effects of the diversions authorized by that act, amounting to 15,600 cubic feet per second on the American side, and on the Canadian side of water sufficient for the development and importation into the United States of 160,000 horsepower, upon the navigable capacity of the Niagara River, on its integrity and proper volume as a boundary stream, on the level of Lake Erie, and on the scenic grandeur of Niagara Falls.

The determination of these questions, so far as physically possible, involves surveys and measurements, of levels, of volumes of discharges, of current velocities and directions, and of depths over the crest of the falls. As these are operations of a character similar to those ordinarily performed by the Lake Survey, upon the recommendation of the Chief of Engineers, the Secretary of War authorized the performance of the work involved therein by the Lake Survey, and for this purpose successive allotments have been made, of which two—one of $5,000 and another of $3,000—pertained to the fiscal years 1907 and 1908. At the beginning of the present fiscal year operations were in progress upon the work covered by the project for the second allotment (that of $3,000 above referred to). These operations had for their purpose the making of such additional discharge measurements in the Niagara River as seemed necessary in order to confirm or else to disprove the conclusion, derived from the observations of 1907, that the increased diversions since 1898 had produced no measurable effect upon the level of Lake Erie. This conclusion appeared so anomalous as to require confirmation or explanation. From July 1 to August 7, 1908, sixty-eight discharge measurements were made and the customary accessory gauge and rating observations made. In addition, the erosible portion of the discharge cross section, at the International Bridge, Buffalo, was sounded, and it was found that spans 1, 3, and 4 had not changed since originally measured in 1899, but that in span 2 there had been an increase in mean depth of over 2 feet. This span, however, carries only 2½ per cent of the flow and the change is therefore of minor consequence.

A shut down of the plant of the Niagara Falls Power Company, covering a large part of the period from 1.30 a. m., July 19, to 7.20 p. m. on August 2, 1908, afforded an unusual opportunity for testing previous deductions concerning, and for ascertaining directly, the effects produced by changes in the quantity of water diverted in the Grass Island-Chippawa pool, and through the courtesy of the company full advantage was taken of this opportunity.

Briefly summarized, the results of the operations of 1908 serve to prove that while the increase in diversion since 1898 in the Chippawa-Grass Island pool, amounting roughly to 7,000 cubic feet per second, has produced no apparent effect upon the level of Lake Erie, this is probably due to the fact that the lowering has been compensated by the construction during the same period of the diversion works of the Ontario Power Company below Chippawa. In the absence of such compensation, the lowering due to the increased diversion would have amounted to less than half an inch. This conclusion is based upon the discovered relation between the volume of the diversion in Chippawa-Grass Island pool at the falls and the discharge of Lake Erie, which, as derived from study of gauge relations and of the measurements during the shut down, shows that any change in the volume of this diversion is accompanied by a change of about one-tenth the amount in the flow at the International Bridge.

In addition, the observations prove that the effect of increased diversion in the above-named pool near the falls, by the American power companies, is to reduce the height of the crest of the American Falls by 0.02 foot for each 10,000 cubic feet so diverted, and that the diversion of the full authorized amount—15,100 cubic feet per second—will lower this crest 0.03 foot, or about three-eighths of an inch. Based as it is upon the extensive observations subsequent to July 1, 1908, this determination serves to modify very materially the result stated in the annual report for 1908, on page 894, the latter being derived from a shut down of a few hours only, during which the change at the crest of the American Falls due to the shut down was coincident with a rise in Lake Erie due to a southwesterly storm.

While the lowering, due to the diversions of the American power companies, may not in itself be noticeable, it is increased to 0.053 foot =0.64 inch by the present diversion of the Ontario Power Company. The combined lowering tends to uncover shallow portions of the crest line of the American Falls. It is further accompanied by greater, and consequently more harmful, effects both in the American rapids and at the easterly or Terrapin Point end of the Horseshoe Fall. Terrapin Point is on the New York side of the boundary and, as depths there are naturally slight, the loss of 2.5 inches in depth, which is the total due to all existing diversions, is a matter of moment in its relation to continuity of crest line. But it is on the Canadian side of the boundary that the impairment of the falls is most serious. At the Canadian end of the Horseshoe Falls, which is known to be deficient in depth, the diversion of 15,100 cubic feet per second produces a lowering of about 4.8 inches, which is increased to 8.44 inches by the present diversions of the Ontario Power Company, the Electrical Development Company, the Canadian Niagara Power Company, and the International Railway Company, whose total diversion is now estimated at 10,950 cubic feet per second. The losses at Terrapin Point and at the west end of the Horseshoe are relatively great and, as a whole, the falls have unquestionably been seriously injured by the diversions already made. Additional diversions, now under way, will add to the damage.

A full report upon the work under these allotments was submitted upon November 30, 1908, and reference is invited to this for detailed statements of ascertained gauge relations and of the effects of diversion upon the rapids, upon the Horseshoe Falls, and upon the Niagara River.

As a result of the discharge measurements made in the intake canal of the Niagara Falls Power Company in 1907 the officer then in charge of the supervision of the operations of the various power and transmission companies, under their permits issued by the Secretary of War, imposed upon this company a limitation to such diversion as might be necessary to generate not to exceed 65,000 electrical horsepower, this limitation being derived from a consideration of the power-house load curves covering the time of the discharge measurements. Comparison served to show that this company generated an electrical horsepower for each 0.123 cubic foot of water diverted, and as the International Paper Company diverted directly from the canal of the power company 700 cubic feet per second there remained for the latter 7,900 cubic feet, corresponding roundly to 65,000 electrical horsepower. The validity of the conversion coefficient for forming switchboard readings into volume of water diverted, so far as it applies to conditions actually existing at the time of the discharge measurements, can not fairly be questioned, but as the two power houses belonging to this company differ in the details of their construction, with claimed higher mechanical efficiency in the newer house, the officials of the company have asserted that under certain entirely practicable conditions of operation the value of the conversion coefficient will be found to be lower than the figures given.

As any unduly high value of this coefficient serves as an unwarranted restriction upon the output of the company and causes a consequent financial loss, upon April 3, 1909, a project was presented contemplating an exhaustive series of tests with discharge measurements under all reasonable probable conditions of operation. Based upon this project an allotment of $5,000 was made upon April 15, 1909, and field operations were begun upon May 4, 1909. To June 30, 198 discharge measurements were made, covering 29 different distributions of the load. Final results are not yet at hand, but it is certain that by restricting the number of generators in operation to 16, with 6 or less in power house No. 1, the Niagara Falls Power Company can generate 75,000 electrical horsepower and at the same time not exceed a maximum diversion of 8,600 cubic feet per second.

The permits now in force for the diversion of water from the Niagara River and for the transmission of electrical energy into the United States from Canada are summarized on page 895 of the Report of the Chief of Engineers for 1908.

To August 14, 1908, the supervision of operations under these permits was performed by Maj. C. W. Kutz, Corps of Engineers. Since that date the work of supervision has been performed by the Lake Survey office. In discharging this duty occasional inspections have been made at irregular intervals, and the detailed results of such inspections have been duly reported to the Chief of Engineers. All the companies concerned have, as disclosed by the inspections, loyally observed the limitations of their corresponding permits.

Amount appropriated by act of June 29, 1906	$50,000.00
July 1, 1908, balance unexpended	40,069.40
June 30, 1909, amount expended during fiscal year	6,592.34
July 1, 1909, balance unexpended	33,477.06

(See Appendix F F F 2.)

IMPROVEMENT OF THE YELLOWSTONE NATIONAL PARK, INCLUDING THE CONSTRUCTION, REPAIR, AND MAINTENANCE OF ROADS AND BRIDGES.

Officers in charge, Capt. E. D. Peek, Corps of Engineers, July 1, 1908, to October 31, 1908; First Lieut. Arthur Williams, Corps of Engineers, November 1, 1908, to March 3, 1909, and First Lieut. Wildurr Willing, Corps of Engineers, March 4, 1909, to June 30, 1909.

The Yellowstone National Park was set apart from the public domain and placed under the control of the Secretary of the Interior by act of Congress of March 1, 1872. The sundry civil act of March 3, 1883, directed the construction and improvement of suitable roads and bridges under the supervision of an engineer officer to be detailed by the Secretary of War, and in July, 1883, an engineer officer was designated accordingly. This was the beginning of systematic road construction in the park. The previous work consisted of the opening of such rough trails as the limited means permitted, but they were temporary in character and of little or no value in the permanent plan. Subsequent to the sundry civil act of August 4, 1886, the expenditure for the improvement was transferred to the War Department, and it has been in the charge of the Engineer Department, with the exception of the period from August, 1894, to March, 1899.

At the outset the officer of the Corps of Engineers in charge adopted a project (described in the Annual Report of the Chief of Engineers for 1887, p. 3134) for a comprehensive system of substantial roads, which, with the change of the act of Congress of March 3, 1891, is the basis of the present system. The sundry civil act of June 6, 1900, directed that the road extensions and improvements should thereafter be made in harmony with a general plan to be approved by the Chief of Engineers. Such plan was approved August 27, 1900, modified by authority of the Secretary of War, dated July 22, 1901, and further modified by approval of the Chief of Engineers, dated July 2, 1902. The sundry civil act of June 28, 1902, recognized this project and provided for its completion, and it was practically finished during the fiscal year ending June 30, 1906. It comprises a belt line or main circuit which reaches all of the important centers of interest, with side roads, bridle trails, and four approaches leading from the park boundary to different points on the belt line—in all, about 350 miles of road and about 125 bridges. The sum expended to June 30, 1909, including maintenance and repairs, is $1,850,426.45. It is estimated that not less than $200,000 of this amount was expended in early work which has since been replaced and does not form a part of the completed system. Maintenance and repairs have cost about $572,757.28, leaving about $1,077,669.17 for the cost of the permanent work. In addition, there has been expended on work done for other departments the sum of $850.95, for which the park appropriation has been reimbursed.

The sundry civil acts of May 27, 1908, and March 4, 1909, provided funds for the maintenance and repair of improvements, and projects for the expenditure were approved July 1, 1908, and May 3, 1909. The work of the past fiscal year under these projects included: General repair and maintenance of the entire system, including the Cooke City, East, West, and South roads; repairs to bridges; laying of tile and iron culverts; the clearing of dead and fallen timber from the roadside · 85 miles of road sprinkled; a number of pumping stations converted into gravity tanks, and hydraulic rams installed; repairs to sprinkling wagons, road graders, carts, and other vehicles; maintenance of trees, shrubs, vines, and lawns. There was expended during the fiscal year 1909, for maintenance and repairs, $80,672.91, and on the East and South roads of the forest reserve, $263.21.

It is proposed to apply the $150,000 estimated as a profitable expenditure during the fiscal year ending June 30, 1911, to work of maintenance and repair, together with the replacing of certain wooden bridges with steel, and commencing the work of resurfacing the system, including the purchase of the plant necessary therefor. The work is necessary to keep the improvement available for use. As stated in the Annual Report of the Chief of Engineers for 1906, page 827, the park is now provided with a comparatively good single-track road system, but the traffic has increased far beyond expectation and much additional work is required to insure comfort and safety. The appropriations of the past five years have proven inadequate for maintenance, and if steps are not taken to solve the road problem mentioned in the Annual Report of the Chief of Engineers for 1905, page 2814, the road bed will soon be in a poor and worn-out condition. Rock-crushing machinery should be purchased, and there is urgent necessity also of replacing certain worn-out wooden bridges with steel, and of substituting walls of concrete or laid in mortar, for dry retaining walls which have become dangerous. On account of the more urgent necessity of this work, and because the clearing of a narrow road through the snow creates a natural channel, through which the melting snow runs down the road, and causes serious erosion, it is considered inadvisable to expend any part of the appropriation for sprinkling, or for clearing the roads in the spring, until the roads, bridges, and trails are put in good condition.

More extended information relating to previous operations is published in the Annual Reports of the Chief of Engineers as follows:

1887, page 3133. A résumé of operations from 1883 to 1887.
1900, page 5420. A general résumé covering the period 1872–1900.
1900, page 5441. The general plan approved August 27, 1900.
1901, page 3797. Modification of 1901 in the general plan of August 27, 1900.
1903, page 2444. General description and technical details of work.
1905, following page 2822. Map of tourist routes.

July 1, 1908, balance unexpended	$66,474.68
Amount received from sales	51.15
Amount appropriated by sundry civil act approved March 4, 1909	65,000.00
	131,525.83
June 30, 1909, amount expended during fiscal year	80,936.12
July 1, 1909, balance unexpended	50,589.71
July 1, 1909, outstanding liabilities	12,036.88
July 1, 1909, balance available	38,552.83
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance and repairs, in addition to the balance unexpended July 1, 1909	150,000.00

(See Appendix G G G.)

ROAD TO MOUNT RAINIER NATIONAL PARK.

Officers in charge, Lieut. Col. H. M. Chittenden, Corps of Engineers, until September 5, 1908, and Maj. C. W. Kutz, Corps of Engineers, since that date.

Prior to the commencement of operations an inferior road led into the park from the western boundary of the forest reserve to Longmire Springs, a distance of about 10½ miles, and rough trails extended thence to the Camp of the Clouds.

The sundry civil act of March 3, 1903, appropriated $10,000 for a survey of the most practicable route for a wagon road into the park and for commencing construction. An estimate of cost, amounting to $183,000.50, was submitted to Congress March 22, 1904, and printed in House Document No. 631, Fifty-eighth Congress, second session, and an appropriation for continuing construction was made in the sundry civil act of April 28, 1904. The project thus authorized by Congress and the one under which work is being carried on contemplates the construction of a wagon road from the western boundary of the forest reserve to the Camp of the Clouds, a distance of about 25 miles.

The total amount appropriated to date is $215,000, of which $17,216.23 were expended on surveys. The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1909, was $193,905.11.

The work accomplished under the various appropriations to the close of the fiscal year ending June 30, 1909, is as follows:

Number of miles of road constructed and in use	17.7
Number of miles of road partially completed	4.1
Total	21.8

The report of the field work of the original survey made in 1903 is printed in the Annual Report of the Chief of Engineers, 1904, page 4207. The general location of the proposed route is shown on the map of the survey made in 1904 for a proposed additional road into the park from the east, printed in House Document No. 283, Fifty-eighth Congress, third session.

To complete the road will require an additional appropriation of $25,000, and that sum is included in the estimate submitted.

The cost of road construction in Mount Rainier National Park is dependent largely on the price of labor. The original estimate was based upon the wages that were current in 1903. During the period of construction wages increased from 20 to 33⅓ per cent, on account of which the latter portions of the road constructed were necessarily of less width and consequently less safe than the portion first constructed.

With the funds requested it is proposed to widen the road built in the season of 1909, and to provide guard walls at dangerous places. This work is necessary to make the road safe and suitable for the traffic that will probably use it.

July 1, 1908, balance unexpended	$52,829.57
Amount appropriated by sundry civil act approved March 4, 1909	25,000.00
	77,829.57
June 30, 1909, amount expended during fiscal year, for works of improvement	56,734.68
July 1, 1909, balance unexpended	21,094.89
July 1, 1909, outstanding liabilities	2,333.16
July 1, 1909, balance available	18,761.73
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for works of improvement, exclusive of the balance unexpended July 1, 1909	25,000.00

(See Appendix H H H.)

MAPS, WAR DEPARTMENT.

With the $5,000 appropriated for this purpose for the fiscal year ending June 30, 1909, a number of maps of maneuver grounds were printed after surveys by engineer troops. A portion of the appropriation has also been applied to the equipment of the office of the chief engineer officer, Philippines Division, with much needed apparatus for the publication of maps in that division.

These funds are also utilized in the publication of accurate maps of our fortified harbors, which, under existing regulations, are required for the use of the coast artillery.

An estimate of $5,000 for this purpose has been submitted for the fiscal year ending June 30, 1911.

BUILDINGS, ARMY WAR COLLEGE, WASHINGTON, DISTRICT OF COLUMBIA, AND ENGINEER SCHOOL, WASHINGTON, DISTRICT OF COLUMBIA.

Officer in charge, Lieut. Col. W. C. Langfitt, Corps of Engineers.

The creation of the engineer post and school at Washington Barracks was authorized by an act of Congress approved June 30, 1902, based on an estimate prepared without funds available for the preparation of detailed plans or for the making of borings, etc. This estimate contemplated the utilization of a number of existing buildings, and provided for construction of new buildings inclosing approximately 4,000,000 cubic feet. A unit price of about 16 cents a cubic foot of cubic space inclosed in buildings, all contingencies included, was practically the basis of this original estimate. Further development of plans for the engineer post, and for the War College building authorized in the same act, led to the approval by the Secretary of War of a transposition of the locations of the two, so that the latter building now occupies the site originally planned for the engineer post. This change led eventually to the abandonment of the effort to utilize old post buildings, which, upon detailed examination, proved also to be in such bad condition as to make repairs expensive and not economical. These facts were reported in general terms in the Annual Report for 1904, page 741, as well as the fact that the subsistence department had utilized the post for a distributing depot, which was not anticipated in the original estimates. The army appropriation act approved June 12, 1906, provided a chaplain for the Corps of Engineers, who has been assigned to station at this post, and a commissary officer has been assigned to permanent station here, both calling for additional quarters.

In view of these and other similar minor changes, the cubic contents of the buildings actually provided were increased by increasing the number of buildings as far as funds would permit, actual construction having been almost exactly the cost per cubic foot of inclosed space as was estimated.

The condition of the work at the close of the fiscal year was as follows:

BUILDINGS, ARMY WAR COLLEGE.

This work is entirely finished and the accounts all settled up. For detailed history of this work, reference is made to the Annual Reports of the Chief of Engineers for the years 1902, 1903, 1904, 1905, and 1906.

BUILDINGS, ENGINEER POST AND ENGINEER SCHOOL.

All appropriations made for this object up to and including the act of March 2, 1907, have been expended and the accounts for those appropriations have been finally settled up. For detailed history of this project reference is made to the Annual Reports of the Chief of Engineers for the years 1902, 1903, 1904, 1905, and 1906.

The completion of stable at $1,700 as estimated for in last annual report was provided for in act of March 3, 1909. The work will be taken up immediately, and the funds provided will be sufficient for the purpose.

On December 22, 1904, the Secretary of War approved a general lay out which, it is thought, completely meets the present needs of the post and school; a drawing of this proposed post accompanied the report of Captain Sewell published in the Annual Report of the Chief of Engineers for 1906. Additional buildings are shown on this sheet; arranged in order of their immediate importance, and with the estimated cost of each stated, they are as follows:

	Estimated cost.
1. Engineer school and administration building, power house, and enlisted men's trade-school building	$429,000

The school building to furnish accommodations for the following:
- Office of commandant of post and of engineer school.
- Office of secretary of school.
- Office of adjutant of the post.
- Office of sergeant-major with clerks.
- Office of clerks, with storage for records of post, and school.
- Office of engineer depot.
- Room for records and small supplies (stationery, etc.) for post, depot, and school.
- Office for orderlies and messengers.
- Office for telephone exchange.
- Printing office, for preparation of orders, blanks forms, lectures, pamphlets, etc.

Offices of instructors, department of civil engineering.
Offices of instructors, department of military engineering.
Offices of instructors, department of electrical and mechanical engineering.
Office for stenographers and clerks.
Two class rooms for use of student officers.
Lecture room.
Library room for library.
Model room for models of engineering structures and appliances.
Photographic laboratory.
Photo-lithographic laboratory.
In basement—
  Cement-testing laboratory.
  Electrical laboratory.
  Chemical and physical laboratory.
Drafting rooms.

Power house and enlisted men's trade-school building to contain:
Heating and power plant.
Electrical generators and other large apparatus.
Machine shop.
Carpenter shop.
Blacksmith shop.
Plumber shop.
Masonry laboratory.
Modeling room (molding sand).

	Estimated cost.
2. Completion of west barracks	$40,000
3. Bachelor officers' quarters	70,000
4. Store sheds for lumber, coal, ponton material, wagons, etc	25,000
5. Observatory	3,000
6. Roads, walks, sidewalks, sewers, water supply, gas, electric distribution	25,000
7. Six sets noncommissioned officers' quarters	66,000
8. One new stable	20,000
9. Chaplain's quarters	20,000
Total amount required	698,000

An estimate of this amount is submitted. This estimate differs from that submitted last year in the omission of item for completion of stable, provided for as above indicated, and in omission of items for hospital and hospital steward's quarters, it being understood that existing regulations require these to be obtained through the Medical Department, which has the matter in hand.

Fuller details of these new buildings and their objects are given in the report of Captain Sewell, published as Appendix H H H of the Annual Report of the Chief of Engineers for 1906.

It is recommended that Congress provide for these items at the coming session, with a view to the early completion of the post and school.

Amount appropriated by act of—	
June 30, 1902	$500,000
March 2, 1903	360,000
March 2, 1905	150,000
March 2, 1907	32,500
	1,042,500
June 30, 1909, amount expended to date	1,042,500

CONSTRUCTION OF BRIDGE ACROSS MISSISSIPPI RIVER BETWEEN FORT SNELLING RESERVATION AND ST. PAUL, MINNESOTA.

This work was in the charge of Maj. Francis R. Shunk, Corps of Engineers.

The act of Congress approved March 17, 1906, provided for construction of a bridge over the Mississippi River connecting Fort Snelling Reservation and St. Paul. The cost was not to exceed $250,000, of which at least $100,000 was to be contributed by the city of St. Paul, at least $25,000 by any electric railway company receiving right of transit across the bridge, and such sum as the Secretary of War might determine by any steam railway company which might use the bridge.

The sum of $100,000 was paid to the United States by the city of St. Paul and the sum of $25,000 by the Twin City Rapid Transit Company.

The site of the new bridge is about 300 feet below the old Fort Snelling bridge.

The bridge was built under contract and was completed April 24, 1909. It was tested June 19, 1909, and formally accepted.

The act of Congress approved March 4, 1909, appropriated $20,000 for the construction of approaches to the bridge. At the close of the year the approaches were about 20 per cent completed.

The amount expended to June 30, 1909, was $245,209.67.

An estimate of $1,200 is submitted for the fiscal year ending June 30, 1911, as the amount required for maintenance and care of the bridge, as follows: Services of a watchman, $600; painting, annual repairs, renewal of wooden surfaces of roadway and foot-path, etc., $600.

July 1, 1908, balance unexpended	$220,905.09
Amount appropriated by sundry civil act approved March 4, 1909	20,000.00
	240,905.09
June 30, 1909, amount expended during fiscal year, for works of improvement	216,114.76
July 1, 1909, balance unexpended	24,790.33
July 1, 1909, outstanding liabilities	2,399.47
July 1, 1909, balance available	22,390.86
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance, exclusive of the balance unexpended July 1, 1909	1,200.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I I I.)

RECONSTRUCTION OF UNITED STATES BRIDGE AT NIOBRARA, NEBRASKA.

This work was in the charge of Maj. Edward H. Schulz, Corps of Engineers.

Funds for this work were appropriated by act of Congress approved April 30, 1908 (Public No. 104), Indian appropriation act, as follows:

> For the purpose of rewooding and repiling the present old bridge across Niobrara River between the Santee and Ponca Reservations, Nebraska, supplying the same

with new ice breaks, but using the iron work of the old combination bridge, the sum of twelve thousand dollars, or so much thereof as may be necessary, the work to be done under the direction and supervision of the War Department.

In accordance with approval of the Secretary of War July 6, 1908, the work was assigned to this office. Bids were invited and opened September 21, 1908, and contract awarded to the Western Bridge and Construction Company, of Omaha, Nebr.

This work was commenced January 11, 1909, and finished and accepted April 28, 1909.

Amount appropriated by act of Congress approved April 30, 1908, Indian appropriation act	$12,000.00
June 30, 1909, amount expended during fiscal year	11,943.11
July 1, 1909, balance unexpended	56.89

(See Appendix J J J.)

ERECTION OF MONUMENT TO THE MEMORY OF THE AMERICAN SOLDIERS WHO FELL IN THE BATTLE OF NEW ORLEANS IN THE WAR OF 1812.

This work was in the charge of First Lieut. Wildurr Willing, Corps of Engineers, to August 22, 1908, and Lieut. Col. Lansing H. Beach, Corps of Engineers, since that date.

By act of Congress approved March 4, 1907, Congress appropriated $25,000 for the completion of a monument to the memory of the American soldiers who fell in the battle of New Orleans in the war of 1812. The design of the monument was approved by the Secretary of War May 17, 1907, and the work of construction and disbursement of funds assigned to the Engineer Department. The site of the monument is at Chalmette, La.

The Chalmette monument was originally designed by Newton Richards, whose plans were accepted by the Jackson Monument Association in May, 1855. This design consisted of a plain shaft 142 feet high, resting on five steps, each 2 feet high and starting about 2 feet 6 inches above the natural surface of the ground; the shaft to be 16 feet 8 inches square at the base and 12 feet 6 inches at the top; the base of the shaft to have on the four faces corniced projections surmounted with sculptured emblems, one of these to serve as an entrance to a spiral stairway leading to a chamber at the top; the stair to be lighted by small openings at regular intervals; both shaft and base to be faced with marble.

A contract for the erection of the monument was awarded in June, 1855, but the work was not completed.

At the time Congress made the above appropriation no work had been done for over fifty years, it is said. The shaft was 56 feet 10 inches high, measuring from the top of the mound of earth about 12 feet 6 inches above the natural surface and about 185 feet in diameter which had been placed around the monument to protect the brick foundation. The base was 16 feet 8 inches square outside and 10 feet 8 inches diameter inside; the top was 14 feet 11 inches square outside and 9 feet 11 inches diameter inside.

Under project approved July 6, 1907, it was proposed to remove the mound of earth covering the base of the existing monument, to extend the shaft on the original lines 24 feet 2½ inches and to place thereon a pyramid 9 feet high, making the top of the monument when completed approximately 100 feet above the natural level of the ground. The entire shaft and base are to be covered with marble. A spiral stairway, with iron steps supported by a central brick pier and the brick lining of shaft, leads to an observation chamber 9 feet 6 inches square in top of monument. There is to be a bronze door at the entrance to the monument, bronze hand rails on both sides of stairway, bronze grilles in the windows of observation chamber, and a bronze historical tablet on the wall of observation chamber.

A contract for the construction of the monument was made with M. P. Doullut, of New Orleans, on December 7, 1907, and the work was commenced January 16, 1908.

The monument was completed by the contractor in December, 1908, and in March, 1909, transferred to the custody of the United [States] Daughters of 1776 and 1812, as required by the act of March 4, 1907, under authority of a letter from the Secretary of War dated March 5, 1909.

The amount expended to June 30, 1909, is $25,000.75, of which $750 was paid for preparation of plans, $23,383.32 to the contractor, and $867.43 for miscellaneous expenses, inspection, etc.; $0.75 was derived from sale of blueprints.

July 1, 1908, balance unexpended	$12,131.19
June 30, 1909, amount expended during fiscal year	12,131.19

(See Appendix K K K.)

MONUMENT TO COMMEMORATE THE BATTLE OF KINGS MOUNTAIN, SOUTH CAROLINA.

This work was in the charge of Capt. Earl I. Brown, Corps of Engineers.

By act of Congress approved June 16, 1906, there was appropriated $30,000 for the construction of a monument to commemorate the victory of the American forces at Kings Mountain, South Carolina, October 7, 1780. Plans for the monument had been approved by the Secretary of War, and contract made for the construction of a monument 115 feet 3 inches high for the sum of $25,000, and work of excavation for the foundation had been begun. During the year in the continuation of this excavation it was necessary, on account of the character of the material of this excavation, to go to a much greater depth than originally estimated, thus increasing the cost of the concrete foundation, and it became evident that the monument originally contemplated could not be constructed with the funds available. Supplemental contract was, therefore, made for the construction of a monument 83 feet 6 inches high, with lightning conductor installed, for the sum of $21,000. Under this contract work was then carried on, and at the close of the year the shaft was completed to its full height, lightning conductor installed, monument washed down, and joints pointed, and the sculptured portion of the monument about 60 per cent completed.

July 1, 1908, balance unexpended	$29,310.38
June 30, 1909, amount expended during fiscal year	20,136.34
July 1, 1909, balance unexpended	9,174.04
July 1, 1909, outstanding liabilities	177.86
July 1, 1909, balance available	8,996.18
July 1, 1909, covered by uncompleted contracts	7,428.70

(See Appendix L L L.)

ERECTION OF MONUMENT AT MONTEREY, CALIFORNIA, TO COMMEMORATE THE TAKING POSSESSION OF THE PACIFIC COAST BY THE LATE COMMODORE JOHN D. SLOAT, UNITED STATES NAVY.

This work was in the charge of Lieut. Col. John Biddle, Corps of Engineers.

During the war with Mexico, on July 7, 1846, Commodore Sloat, in accordance with instructions from our Government, landed a force of sailors and marines at Monterey and took possession of California in the name of the United States. In 1886 an organization composed of Mexican war veterans, California pioneers, army and navy officers, and others prominent in the affairs of the State, was formed for the purpose of erecting a monument to Commodore Sloat, the organization being known as the Sloat Monument Association.

A site was procured on the military reservation of the Presidio of Monterey, on the slope of a hill overlooking the Bay of Monterey. Upon this site, which is unobstructed by trees or adjacent buildings, a suitable foundation was laid and a base, or platform, for the proposed monument was constructed, faced with stones which were contributed by various counties of the State, military and civic organizations. The base is 24 feet square and 6 feet high.

The Congress of the United States, act of March 4, 1907, has appropriated $10,000 for the erection of a monument to Commodore John Drake Sloat, U. S. Navy, at Monterey, Cal. A portion of this sum, not to exceed $1,000, is to be devoted to procuring a suitable design and other preliminary expenses, leaving about $9,000 for the actual work, act of March 28, 1908.

The amount expended on this base is unknown in this office.

On May 19, 1908, the Chief of Engineers, U. S. Army, assigned to Lieutenant-Colonel Biddle the duty of obtaining a suitable design and erecting the monument. With the aid of the San Francisco Art Institute and the Sloat Monument Association, a design was accordingly made and has been submitted to the War Department, and was approved by the Secretary of War on June 29, 1909.

The total amount expended on the project to June 30, 1909, is $333.45. Nothing has been derived from any miscellaneous sources.

The work accomplished during the year consists of obtaining a suitable design and perfecting it and having it approved. Competitive designs were obtained by offering three prizes of $250, $150, and $100, respectively. The work of erecting the monument will be awarded the winner of the first prize, and the work will be done under contract.

The proportion of the project completed up to June 30, 1909, can not be readily ascertained, but it consists of obtaining a suitable design, and the work left to be done is to erect the monument in accordance with the design.

No former reports have been made on the project.

July 1, 1908, balance unexpended	$9,998.92
June 30, 1909, amount expended during fiscal year	332.37
July 1, 1909, balance unexpended	9,666.55
July 1, 1909, outstanding liabilities	250.00
July 1, 1909, balance available	9,416.55

(See Appendix M M M.)

MONUMENT TO COMMEMORATE THE BATTLE OF THE REVOLUTION FOUGHT AT POINT PLEASANT, WEST VIRGINIA.

This work was in the charge of Capt. F. W. Altstaetter, Corps of Engineers.

The public building act approved May 30, 1908, appropriates the sum of $10,000 to aid in the erection and completion of a memorial structure at Point Pleasant, W. Va., to commemorate a battle of the Revolution fought at that point.

A contract was entered into February 5, 1909, for the construction of the monument, the base for which was built. Some work was also done on the six courses above the base, two courses being completed.

Amount appropriated by public building act approved May 30, 1908	$10,000.00
June 30, 1909, amount expended during fiscal year	1,000.25
July 1, 1909, balance unexpended	8,999.75
July 1, 1909, amount covered by uncompleted contract	8,500.00

(See Appendix N N N.)

OFFICE OF THE CHIEF OF ENGINEERS.

During the fiscal year ending June 30, 1909, the following-named officers were on duty in this office as assistants: Col. Smith S. Leach; Col. Frederic V. Abbot; Maj. James B. Cavanaugh; Maj. William B. Ladue from January 21, 1909; Maj. William J. Barden; Capt. Edward N. Johnston from September 1, 1908; First Lieut. Richard C. Moore from November 19, 1908.

I desire to express my appreciation of the very able and loyal assistance I have received from the civilian employees of this office. They are intelligent, conscientious, and efficient in the discharge of their duties, and many of them have given to the Government the best years of their lives; in some cases the entire wage-earning period has been spent in the government service.

Excepting in very rare instances the compensation received by this worthy class of public servants has been entirely too small to permit any provision being made by them for support in old age, and it would be gratifying to see some action by Congress looking to the relief of these employees as they become superannuated in the public service.

Very respectfully,

W. L. Marshall,
Chief of Engineers, U. S. Army.

The Secretary of War.

INDEX.

A.

- Aberdeen, Wash. *See* Chehalis River *and* Grays Harbor.
- Absecon Inlet, N. J.: **Page.**
  - Harbor lines established in 910
  - Wreck in 224
- Academy Creek, Ga. *See* Brunswick Harbor.
- Acushnet River, Mass. *See* New Bedford Harbor.
- Adams Creek, N. C., waterway via. *See* Beaufort Inlet.
- Agate Bay Harbor, Minn., improvement of 660
- Ahnapee (Algoma) Harbor, Wis. *See* Algoma Harbor.
- Alabama River, Ala.:
  - Examination and survey from Montgomery to Coosa River 409
  - Improvement of 404
- Alameda, Cal. *See* Oakland Harbor.
- Alaska, improvement of St. Michael Canal 891
- Albemarle and Chesapeake Canal, N. C. *See* Albemarle Sound-Norfolk waterway.
- Albemarle Sound, N. C.:
  - Improvement of waterway to Norfolk, Va., via Currituck Sound 284
  - Improvement of waterway to Norfolk, Va., via Pasquotank River 282
- Alexandria, Va.:
  - Harbor lines in Potomac River at 910
  - Wreck in Potomac River at 272
- Algoma Harber, Wis., improvement of 690
- Allegheny River, Pa.:
  - Construction of locks and dams 618
  - Harbor lines from Lock No. 2 to upper end of Brilliant pumping station.. 911
  - Improvement by open-channel work 617
  - Improvement of Pittsburg Harbor 625
  - Operating and care of locks and dams 620
- Allouez Bay, Wis. *See* Duluth Harbor.
- Alloway Creek, N. J., improvement of 205
- Alpena Harbor, Mich.:
  - Improvement of 763
  - Wreck in 780
- Altamaha River, Ga., improvement of 343
- Ambrose channel, New York Harbor, N. Y., improvement of, including dredge construction 159
- Amelia River, Fla. *See* Fernandina.
- Amite River, La., improvement of 454, 458
- Anacostia River, D. C.:
  - Improvement of 252
  - Wrecks near James Creek Canal 272
- Anahuac channel, Tex., improvement of 478, 480
- Anclote River, Fla.:
  - Improvement of 379
  - Wreck in anchorage 384
- Anita rock, San Francisco Harbor, Cal., examination and survey 834
- Ann, Cape, Mass., harbor of refuge. *See* Sandy Bay.
- Apalachicola Bay, Harbor, and River, Fla.:
  - Improvement of harbor in bay 388
  - Improvement of river, including the Cut-off 390
  - Regulations governing navigation of inner channel 911

Appomattox River, Va.: Page.
    Improvement of (general) 279
    Improvement at Petersburg 280
Appoquinimink River, Del., improvement of 214
Appropriations:
    Fortifications 11, 19
    Rivers and harbors 28, 29, 904
Aqueduct Bridge, Washington, D. C., repair of 921
Aqueduct, Washington, D. C. *See* Washington.
Aransas Bay and Pass, Tex.:
    Improvement of channel to Pass Cavallo, to Victoria (on Guadalupe River), and to Corpus Christi (via Turtle Cove) 488
    Improvement of pass 493
Arcadia Harbor, Mich., improvement of 748
Arcata, Cal. *See* Humboldt Harbor.
Arkansas River:
    Examination and improvement at Pine Bluff, Ark 538, 539, 548
    Examination at Douglas, Ark 548
    Examination to Muskogee, Okla 548
    Improvement of 532
Armament. *See* Fortifications.
Army War College, Washington, D. C., erection of buildings for 946
Arroyo Colorado, Tex., examination and survey from Harlingen to Point Isabel, on Laguna Madre 497
Arthur Kill, N. Y. and N. J.:
    Harbor lines around Buckwheat Island and Morse Creek, N. J 910
    Improvement of 168
Arthur Lake, Mermentau River, La. *See* Mermentau River.
Ashland Harbor, Wis., improvement of 669
Ashtabula Harbor, Ohio, improvement of 794
Assistants:
    Civilian, to engineer officers 27
    On duty in Office of the Chief of Engineers 952
Atlantic City, Absecon Inlet, N. J., harbor lines at 910
Atlantic Ocean, wreck at entrance to Hereford Inlet, N. J 224
Augusta, Ga. *See* Savannah River.
Augusta Narrows, White River, Ark., examination and improvement at 548
Aux Becs Scies Lake, Mich. *See* Frankfort Harbor.

B.

Back Bay of Biloxi, Miss.:
    See also Biloxi Harbor.
    Examination and survey 439
Back Cove, Portland Harbor, Me. *See* Portland Harbor.
Back (Weymouth) River, Mass. *See* Weymouth River.
Bagaduce River, Me., improvement of 34
Ballard, Wash. *See* Puget Sound-Lake Washington waterway.
Baltimore Harbor, Md.:
    Defenses of 10
    Improvement at Spring Garden 228
    Improvement of channel to 224
    Improvement of channel to Curtis Bay 227
    Harbor lines in Curtis Bay 910
Bangor Harbor, Me. *See* Penobscot River.
Bar Harbor, Me., construction of breakwater 31
Bar Lake, Mich. *See* Arcadia Harbor.
Barracks, Washington, D. C. *See* Washington Barracks.
Barren River, Ky., operating and care of lock and dam 655
Bartholomew Bayou, La. and Ark., improvement of 519
Bastrop Bayou, Tex., improvement of 478, 484
Battalions of Engineers:
    Equipment of 25
    Proposed increase in number 7
Batteries, gun and mortar. *See* Fortifications.
Battery, the, New York Harbor, N. Y. *See* New York Harbor.
Battles:
    Of Kings Mountain. *See* Kings Mountain.
    Of New Orleans. *See* New Orleans.
    Of Point Pleasant, W. Va. *See* Point Pleasant.

Page.
Bay Ridge channel, New York Harbor, N. Y., improvement of.... 162
Bayside channel, New York Harbor, N. Y. *See* New York Harbor.
Beaufort Harbor, N. C.:
  Examination and survey of channel across the bar.... 315
  Improvement of.... 300
  Improvement of waterway to Newbern.... 299
  Improvement of waterway to New River.... 303, 304
Beaufort Harbor, S. C. *See* Beaufort River and Harbor.
Beaufort Inlet, N. C.:
  Improvement of.... 302
  Improvement of waterway to Pamlico Sound.... 298
Beaufort River and Harbor, S. C.:
  Waterway to Savannah (*see* Savannah Harbor).... 333
  Wreck in.... 332
Bee Tree Shoals Canal, Tennessee River, Ala. *See* Tennessee River.
Bellingham Bay and Harbor, Wash.:
  Examination and survey of harbor.... 893
  Improvement of Whatcom Creek waterway (New Whatcom Harbor).... 887
Benton Harbor Canal, Mich. *See* St. Joseph Harbor.
Beverly Harbor, Mass., improvement of.... 55
Big Barren River, Ky. *See* Barren River.
Big Kanawha River, W. Va. *See* Kanawha River.
Big Sandy River, W. Va. and Ky.:
  Improvement of, including Tug and Levisa forks.... 638
  Operating and care of locks and dams.... 640
Big Sarasota Bay, Fla. *See* Sarasota Bay.
Big Sioux River, S. Dak., ice harbor at Sioux City, Iowa. *See* Missouri River improvement.
Big Stone Lake, Minn.:
  Examination of Bois de Sioux River, Lake Traverse, and, for diversion of flood waters of Red River of the North into Minnesota River.... 573
  Survey of (hydrological observations).... 573
Big Sunflower River, Miss.:
  Examination and survey from near Baird to mouth of Hushpucena River.. 532
  Improvement of.... 526, 529
Biloxi Harbor, Miss.:
  Examination and survey, including Back Bay.... 439
  Improvement of.... 431
Biscayne Bay, Fla., improvement of.... 368
Bismarck Harbor, N. Dak. *See* Missouri River improvement.
Blackfish Bayou, Ark., examination and survey to Fivemile Bayou.... 548
Black Lake, Mich. *See* Holland Harbor.
Black Mingo Creek, S. C. *See* Mingo Creek.
Black River, Ark. and Mo., improvement of.... 542
Black River, La., improvement of.... 515
Black River, Mich.:
  Improvement at mouth.... 769
  Improvement at Port Huron.... 774
Black River, N. C., improvement of.... 307, 308
Black River, Lorain, Ohio. *See* Lorain Harbor.
Black Rock Harbor, Conn. *See* Bridgeport Harbor.
Black Rock Harbor, N. Y.:
  Improvement of, including lock construction.... 804
  Improvement of Buffalo entrance.... 803
  Improvement of Lake Erie entrance.... 802
Black Warrior River, Ala.:
  Improvement above Tuscaloosa.... 414
  Improvement below Tuscaloosa.... 414, 415
  Operating and care of locks and dams.... 423
Blackwater Creek, or River, Va., improvement of.... 286
Blackwater River, Fla., improvement of.... 399
Block Island, R. I.:
  Construction of harbor of refuge.... 97
  Improvement of Great Salt Pond.... 98
Blood River, La. *See* Tickfaw River.

Boards (*see also* Commissions): Page.
  National Coast Defense Board.................................... 10
  Of Engineers for Rivers and Harbors.................................... 898
  On Fortifications or other Defenses (Endicott Board).................................... 10
  The Board of Engineers.................................... 10
Boats. *See* Dredge boats *and* Wrecks.
Boca Ceiga Bay, Fla., examination and survey from Clearwater Harbor to Tampa Bay, including.................................... 385
Boeuf River, La., improvement of.................................... 519, 520
Bogue Chitto, La., improvement of.................................... 454
Bogue Falia, La., improvement of.................................... 454, 455
Bogue Sound, N. C., improvement of waterways via. *See* Beaufort Harbor—New River waterway.
Bois de Sioux River, Minn. and N. Dak., examination of Big Stone Lake, Lake Traverse, and for diversion of flood waters of Red River of the North into Minnesota River.................................... 573
Bonita channel, San Francisco Harbor, Cal., examination and survey of rocks near.................................... 834
Booms, building of.................................... 920
Bordentown bar, Delaware River, improvement of.................................... 194
Boston Harbor, Mass.:
  See also Dorchester Bay *and* Malden, Mystic, *and* Neponset rivers.
  Defenses of.................................... 10
  Improvement of.................................... 60
  Wrecks in.................................... 77
Brandywine Creek, or River, Del. *See also* Wilmington Harbor.
Branford Harbor, Conn., improvement of.................................... 107
Brazos River, Tex.:
  Examination and survey of mouth.................................... 497
  Improvement between Old Washington and Waco.................................... 503
  Improvement between Velasco and Old Washington.................................... 505
  Improvement of mouth.................................... 492
  Improvement of Galveston and Brazos Canal.................................... 491
  Improvement of waterway to Galveston.................................... 469
  Operating and care of Galveston and Brazos Canal.................................... 491
Brazos Santiago Harbor, Tex., improvement of.................................... 495
Breton Bay, Md., improvement of.................................... 254
Bridge Creek Landing, Va., wharf and monument. *See* Wakefield.
Bridgeport Harbor, Conn.:
  Improvement of.................................... 114
  Wreck in.................................... 124
Bridges:
  Alteration of, obstructing navigation.................................... 919
  Aqueduct Bridge, Washington, D. C.................................... 921
  Construction of, across navigable waters.................................... 912
  Highway Bridge, Washington, D. C.................................... 923
  Mississippi River, between Fort Snelling and St. Paul, Minn.................................... 948
  Niobrara River, Nebr.................................... 948
  Roadway at tidal reservoir, Washington, D. C.................................... 248
  Rules governing opening of draws.................................... 911
  Yellowstone National Park.................................... 942
Broad Creek River, Del., improvement of.................................... 244
Broadkill Creek, or River, Del., improvement of.................................... 222
Broad Sound, Boston Harbor, Mass. *See* Boston Harbor.
Bronx River, N. Y.:
  Improvement of.................................... 129
  Wreck in.................................... 157
Brooklyn, N. Y. *See* East River, Gowanus Bay, *and* Newtown Creek.
Brothertown Harbor, Wis. *See* Fox River.
Browns Creek, N. Y., improvement of.................................... 145
Brunswick Harbor, Ga., improvement of.................................... 350
Brunswick River, N. C. *See* Cape Fear River below Wilmington.
Brush (or Bush) Creek, Va., dredging of, in connection with Jamestown Exposition.................................... 271
Buckwheat Island, Arthur Kill, N. J., harbor lines around.................................... 910
Budd Inlet, Wash. *See* Olympia Harbor.

Page.

Buffalo Bayou, Tex.:
  Improvement of 475
  Regulations governing navigation of 911
Buffalo Creek, or River, N. Y. *See* Buffalo Harbor improvement.
Buffalo Harbor, N. Y.:
  Improvement of 800
  Improvement of Black Rock Harbor and channel 804
  Improvement of Buffalo entrance to Erie Basin and Black Rock Harbor .. 803
  Improvement of channels in waters connecting Great Lakes 753
  Improvement of Lake Erie entrance to Erie Basin and Black Rock Harbor. 802
Buffalo River, or Creek, N. Y. *See* Buffalo Harbor improvement.
Buildings:
  Army War College, Washington, D. C 945
  Engineer Post and School, Washington, D. C 945
  Public, District of Columbia 929
Bulkhead lines, establishment of 910
Bullis, Spencer S., contract with. *See* Gulfport Harbor.
Burlington Harbor, Vt.:
  Examination and survey 78
  Improvement of 75
Burr Creek, Conn. *See* Bridgeport Harbor.
Bush (or Brush) Creek, Va., dredging of, in connection with Jamestown Exposition 271
Byram River, N. Y. *See* Port Chester Harbor.

C.

Cable galleries. *See* Fortifications.
Cache River, Ark., improvement of 541
Caddo Lake, Tex. and La., improvement of Cypress Bayou 507
Calaveras River, Cal. *See* Mormon Channel.
Calcasieu Pass and River, La., improvement of 452
California Débris Commission 905
Caloosahatchee River, Fla., improvement of 371, 372
Calumet Harbor, Wis. *See* Fox River.
Calumet Harbor and River, Ill. and Ind.:
  Improvement of harbor (South Chicago Harbor) 711
  Improvement of river 713
  Reversing flow of river 715
  Wrecks in river near Ninety-third street 718
Cambridge Harbor, Md., improvement of 231, 235
Camden Harbor, Me., examination and survey 47
Camden Harbor, N. J. *See* Cooper Creek *and* Delaware River.
Canada, Dominion of:
  Commerce through St. Marys Falls Canal. *See* St. Marys Falls Canal.
  Transmission of electrical power into United States at Niagara Falls 939, 941
Canals, locks, and dams (*see also* Waterways):
  Albemarle and Chesapeake Canal, N. C. *See* Albemarle Sound-Norfolk waterway.
  Allegheny River, Pa., locks and dams. *See* Allegheny River.
  Appropriation for operation and care 28, 29
  Barren River, Ky., lock and dam. *See* Barren River.
  Bee Tree Shoals Canal, Ala. *See* Tennessee River.
  Benton Harbor Canal, Mich. *See* St. Joseph Harbor.
  Big Barren River, Ky., lock and dam. *See* Barren River.
  Big Kanawha River, W. Va., locks and dams. *See* Kanawha River.
  Big Sandy River, W. Va. and Ky., locks and dams. *See* Big Sandy River.
  Black Rock Harbor, N. Y., lock. *See* Black Rock Harbor.
  Black Warrior River, Ala., locks and dams. *See* Black Warrior River.
  Brazos River, Tex., locks and dams. *See* Brazos River.
  Brazos River, Tex., to Galveston. *See* Galveston and Brazos Canal *and* West Galveston Bay.
  Caddo Lake, Tex. and La., dam. *See* Caddo Lake.
  Calaveras River, Cal., to Mormon Channel, San Joaquin River. *See* Mormon Channel.
  Canadian Canal, St. Marys River, Ont., commerce. *See* St. Marys Falls Canal.
  Cape Fear River above Wilmington, N. C., locks and dams. *See* Cape Fear River.

Canals, locks, and dams (*see also* Waterways)—Continued. **Page.**
- Care and maintenance, appropriation for........ 28, 29
- Cascades Canal, Columbia River, Oreg. *See* Columbia River.
- Chicago (Lockport), Ill., to St. Louis, Mo., and the Gulf, 14-foot waterway. *See* Chicago Harbor.
- Club Creek, Ga., to Plantation Creek. *See* Club Creek.
- Clubfoot and Harlowe Canal, N. C. *See* Newbern-Beaufort waterway.
- Colbert Shoals Canal, Ala. *See* Tennessee River.
- Columbia River, Cascades Canal. *See* Columbia River.
- Columbia River, The Dalles Rapids to Celilo Falls, locks and canal. *See* Columbia River.
- Congaree River, S. C., lock and dam. *See* Congaree River.
- Coosa River, Ga. and Ala., locks and dams. *See* Coosa River.
- Cumberland River, Tenn. and Ky., locks and dams. *See* Cumberland River.
- Dams, permits for erection of........ 920
- Delaware Bay, Del., to Rehoboth Bay. *See* Delaware Bay.
- Des Moines Rapids Canal, Mississippi River. *See* Mississippi River.
- Des Plaines River, Ill., 14-foot waterway via. *See* Chicago Harbor.
- Dismal Swamp Canal, Va. and N. C. *See* Norfolk-North Carolina sounds waterway.
- Duluth Canal, Minn. *See* Duluth Canal.
- Elk River Shoals Canal, Ala. *See* Tennessee River.
- Estherville-Minim Creek Canal, S. C. *See* Estherville-Minim Creek Canal.
- Expenditures for operation and care........ 28, 29
- Fox River, Wis., locks and dams. *See* Fox River.
- Galena River, Ill., lock and dam. *See* Galena River.
- Galveston, Tex., to Brazos River. *See* Galveston and Brazos Canal *and* West Galveston Bay.
- Great Kanawha River, W. Va., locks and dams. *See* Kanawha River.
- Green River, Ky., locks and dams. *See* Green River.
- Hales bar, Tennessee River, lock and dam. *See* Tennessee River.
- Illinois and Mississippi Canal, Ill. *See* Illinois and Mississippi Canal.
- Illinois River, Ill., locks and dams. *See* Illinois River.
- Illinois River, Ill., 14-foot waterway from Lockport (Chicago) to St. Louis, Mo., and mouth of the Mississippi. *See* Chicago Harbor.
- Kanawha River, W. Va., locks and dams. *See* Kanawha River.
- Kentucky River, Ky., locks and dams. *See* Kentucky River.
- Keokuk (Des Moines Rapids) Canal, Mississippi River. *See* Mississippi River.
- Keweenaw Bay to Lake Superior. *See* Keweenaw Bay-Lake Superior waterway.
- Lake Washington Canal, Wash. *See* Puget Sound-Lake Washington waterway.
- Levisa Fork, Big Sandy River, Ky., locks and dams. *See* Big Sandy River.
- Little Kanawha River, W. Va., locks and dams. *See* Little Kanawha River.
- Lockport, Ill., to St. Louis, Mo., and mouth of the Mississippi, 14-foot waterway. *See* Chicago Harbor.
- Louisville and Portland Canal, Ky. *See* Ohio River.
- Michigan Lake to St. Louis, Mo., and the Gulf, 14-foot waterway. *See* Chicago Harbor.
- Michigan Lake to Sturgeon Bay. *See* Sturgeon Bay and Lake Michigan Canal.
- Minim Creek-Estherville Canal, S. C. *See* Estherville-Minim Creek Canal.
- Mississippi River, Des Moines Rapids Canal. *See* Mississippi River.
- Mississippi River to Illinois River. *See* Illinois and Mississippi Canal.
- Mississippi River, Moline, Ill., lock and dam. *See* Mississippi River.
- Mississippi River, reservoirs. *See* Mississippi River.
- Mississippi River, St. Paul to Minneapolis, locks and dams. *See* Mississippi River.
- Mississippi River, 14-foot waterway from mouth to St. Louis, Mo., and Lockport (Chicago), Ill. *See* Mississippi River.
- Moline Harbor, Ill., lock and dam. *See* Mississippi River.
- Monongahela River, W. Va. and Pa., locks and dams. *See* Monongahela River.
- Morgan Canal, Tex. *See* Morgan Canal.
- Mormon Channel, San Joaquin River, Cal., to Calaveras River. *See* Mormon Channel.

Canals, locks, and dams (*see also* Waterways)—Continued. Page.
Mosquito Creek Canal, S. C. *See* Santee River.
Muscle Shoals Canal, Ala. *See* Tennessee River.
Muskingum River, Ohio, locks and dams. *See* Muskingum River.
Navigation of, regulations for 911
North Carolina Cut, N. C., waterway via. *See* Norfolk-Albemarle Sound waterway.
Ohio River, locks and dams. *See* Ohio River.
Ohio River, Louisville and Portland Canal. *See* Ohio River.
Operation and care, appropriation for 28, 29
Osage River, Mo., lock and dam. *See* Osage River.
Ouachita River, Ark. and La., locks and dams. *See* Ouachita River.
Permanent appropriation for operation and care 28
Plantation Creek, Ga., to Club Creek. *See* Plantation Creek.
Plaquemine Bayou, La., lock. *See* Plaquemine Bayou.
Portage Lake canals, Mich. *See* Keweenaw Bay-Lake Superior waterway.
Port Arthur Canal, Tex. *See* Port Arthur Canal.
Potomac River at Washington, D. C., lock at tidal reservoir. *See* Potomac River.
Puget Sound-Lake Washington waterway. *See* Puget Sound-Lake Washington waterway.
Regulations for navigation of 911
Rock River, Ill. *See* Illinois and Mississippi Canal.
Rough River, Ky., lock and dam. *See* Rough River.
Rules for navigation of 911
St. Clair Flats Canal, Mich. *See* St. Clair Canal and River.
St. Louis, Mo., 14-foot waterway from Lockport (Chicago), Ill., to, and mouth of the Mississippi. *See* Mississippi River.
St. Marys Falls Canal, Mich. *See* St. Marys River, etc.
St. Michael Canal, Alaska. *See* St. Michael Canal.
Salmon Bay, Wash., waterway via. *See* Puget Sound-Lake Washington waterway.
San Joaquin River, Cal., Mormon Channel to Calaveras River. *See* Mormon Channel.
Scott Point, Tennessee River, lock and dam at Hales bar. *See* Tennessee River.
Seattle Canal, Wash. *See* Puget Sound-Lake Washington waterway.
Shilshole Bay, Wash., waterway via. *See* Puget Sound-Lake Washington waterway.
Sturgeon Bay and Lake Michigan Canal, Wis. *See* Sturgeon Bay and Lake Michigan Canal.
Superior Lake to Keweenaw Bay. *See* Superior Lake.
Teche Bayou, La., lock and dam. *See* Teche Bayou.
Tennessee River, canals, locks, and dams. *See* Tennessee River.
Tombigbee River, Ala., locks and dams. *See* Tombigbee River.
Trinity River, Tex., locks and dams. *See* Trinity River.
Tug Fork, Big Sandy River, W. Va. and Ky., locks and dams. *See* Big Sandy River.
Turners Cut, N. C., waterway via. *See* Norfolk-North Carolina sounds waterway.
Union Lake, Wash., waterway via. *See* Puget Sound-Lake Washington waterway.
Wabash River, lock and dam. *See* Wabash River.
Warrior River, Ala., locks and dams. *See* Warrior River.
Washington, D. C., lock at tidal reservoir, Potomac River. *See* Potomac River.
Washington Lake to Puget Sound, waterway. *See* Puget Sound-Lake Washington waterway.
Washita (Ouachita) River, Ark. and La., locks and dams. *See* Ouachita River.
West Galveston Bay and Brazos River Canal, Tex. *See* Galveston and Brazos Canal *and* West Galveston Bay.
White River, Ark., locks and dams. *See* White River.
Yamhill River, Oreg., lock and dam. *See* Yamhill River.
Yuba River, Cal., restraining dam. *See* California Débris Commission.
Canarsie Bay, N. Y., improvement of 132, 137
Cane River, La., improvement of 514

Page.

Caney Fork River, Tenn., improvement of 591
Cape Ann, Mass., harbor of refuge. *See* Sandy Bay.
Cape Charles City Harbor, Va., improvement of 281
Cape Fear River, N. C.:
  Defenses of 10
  Improvement above Wilmington 307, 310
  Improvement at and below Wilmington 311
  Improvement of Northeast Branch 307
  Wrecks near Fort Caswell 315
Cape May N. J. *See* Cold Spring Inlet.
Cape May Real Estate Company. *See* Cold Spring Inlet.
Cape Porpoise Harbor, Me.:
  Improvement of 44
  Wreck in 47
Cape Vincent Harbor, N. Y., improvement of 813
Capitol, Washington, D. C., telegraph line. *See* Public buildings and grounds.
Carquinez Strait, Cal., examination and survey from San Francisco Bay to Stockton, including 834
Carrabelle Harbor and River, Fla., improvement of 386
Carriages, gun and mortar. *See* Fortifications.
Carters Creek, Va., improvement of 256, 261
Cascades Canal, Columbia River, Oreg.:
  Construction of 852
  Operating and care 854
Casemates, mining. *See* Fortifications.
Castlerock, Wash., examination and survey of Cowlitz River up to 871
Caswell, Fort, N. C., wrecks near 315
Cavallo, Pass, Tex.:
  Examination and survey of channel to Port Lavaca 497
  Examination and survey to Port O'Connor (on Matagorda Bay) for harbor. 497
  Improvement of channel to Aransas Pass 497
Cedar Bayou, Tex., improvement of 478, 481
Cedar Creek, Conn. *See* Bridgeport Harbor.
Centissima rock, San Francisco Harbor, Cal., examination and survey 834
Chalmette, La., monument to memory of soldiers who fell in the battle of New Orleans 949
Chambersia (Anahuac) channel, Tex. *See* Anahuac channel.
Champlain Lake, N. Y. and Vt.:
  Burlington Harbor, Vt. *See* Burlington Harbor.
  Narrows, improvement of 76
  North and South Hero islands channel (The Gut), Vt., improvement of .. 74
  North and South Hero islands channel (The Gut), examination and survey. 78
  St. Albans Harbor, Vt. *See* St. Albans Harbor.
Channels. *See* Rivers and harbors.
Charles River, Boston, Mass., improvement of 63
Charleston Harbor, S. C.:
  Defenses of 10, 15
  Improvement of 320
  Improvement of waterway to McClellanville 329
  Wrecks in and near entrance 332
Charlevoix Harbor, Mich., improvement of 750
Charlotte Harbor, Fla., improvement of 371, 372
Charlotte Harbor, N. Y., improvement of 806
Charts. *See* Maps.
Chattahoochee River, Ga. and Ala., improvement of, below Columbus 395
Chattanooga, Tenn. *See* Tennessee River.
Cheboygan Harbor, Mich., improvement of 761
Cheesequake Creek, N. J., improvement of 174, 182
Chefuncte River, La., improvement of 454, 455
Chehalis River, Wash.:
  Examination and survey up to Montesano 893
  Improvement of 875
Chelsea Creek, Mass. *See* Boston Harbor.
Chequamegon Bay, Wis. *See* Ashland Harbor.

Chesapeake Bay, Md. and Va.: Page.
Defenses at entrance 10
Waterway to Albermarle Sound. *See* Norfolk-Albermarle Sound waterway.
Waterway to sounds of North Carolina (to Pamlico Sound). *See* Norfolk-North Carolina sounds waterway.
Wreck near Sevenfoot Knoll, Md 247
York Spit, shoals opposite. *See* Patapsco River channel to Baltimore.
Chester River, Md., improvement of 231, 236
Chicago Harbor and River, Ill.:
Calumet Harbor and River. *See* Calumet Harbor and River.
Channels in waters connecting Great Lakes, improvement of 753
Improvement of harbor 706
Improvement of river 708
South Chicago Harbor. *See* Calumet Harbor and River.
Survey for 14-foot waterway from Lockport to St. Louis, Mo., and the Gulf, including report on water power and land drainage 908
Wrecks near South Chicago breakwater and near Fullerton avenue and Davidson street 718
Chickasahay River, Miss., improvement of 427, 428
Chief of Engineers, officers on duty in Office of the 952
Chincoteague Inlet, Va., wreck in 223
Chipola River, Fla.:
Improvement of lower river 390
Improvement of upper river 390, 391
Chitto, Bogue, La., improvement of 454
Chocolate Bayou, Tex., improvement of 478, 485
Choctawhatchee River, Fla. and Ala., improvement of 397
Choptank River, Md.:
See also Cambridge Harbor.
Improvement of 231, 237
Christiana River, Del., improvement of Wilmington Harbor 212
Cincinnati, Ohio. *See* Ohio River.
Civilian assistants to engineer officers 27
Claiborne Harbor, Md., improvement of 231, 233
Clark Creek, or River, S. C., improvement of 319
Clark Fork, Columbia River, Wash. *See* Pend Oreille River.
Clatskanie River, Oreg., improvement of 865
Clear Creek, Tex., improvement of 482
Clearwater Harbor, Fla., examination and survey, including Boca Ceiga Bay to Tampa Bay 385
Cleveland Harbor, Ohio:
Improvement of 789
Wreck in 797
Clinch River, Tenn., improvement of 602
Clinton River, Mich., improvement of 776
Club Creek, Ga., improvement of 349
Clubfoot and Harlowe Canal, N. C., waterway via. *See* Newbern-Beaufort waterway.
Clubfoot Creek, N. C., waterway via. *See* Newbern-Beaufort waterway.
Coanjock Bay, N. C., waterway via. *See* Norfolk-Albemarle Sound waterway.
Coast defenses. *See* Fortifications.
Cocheco River, N. H., improvement of 46
Cohansey River, N. J., improvement of 207
Coit (Shaws) Cove, New London Harbor, Conn. *See* New London *and* Thames River.
Colbert Shoals Canal, Tennessee River, Ala., improvement of 595
Cold Spring Inlet, N. J., improvement of 210
Coldwater River, Miss., improvement of 526, 527
College, War, Army, Washington, D. C., erection of buildings for 945
Colorado River, Tex., examination and survey 497
Colorado (Arroyo) River, Tex., examination and survey from Harlingen to Point Isabel, on Laguna Madre 497
Columbia River, Oreg. and Wash.:
Cascades Canal, construction of 852
Cascades Canal, operating and care 854
Celilo Falls to Snake River, including tributaries, improvement from 848
Celilo Falls to The Dalles Rapids, improvement from 850

Columbia River, Oreg. and Wash.—Continued. Page.
  Clark Fork. *See* Pend Oreille River.
  Gauging........ 870
  Mouth, defenses at........ 10
  Mouth, improvement at........ 862
  Mouth to Willamette River, improvement from, including dredge construction........ 859
  Regulations governing navigation of........ 911
  Threemile Rapids, improvement at........ 850
  Vancouver, Wash., to Willamette River, improvement from........ 854
  Wenatchee, Wash., to Bridgeport, improvement from........ 888
Commencement Bay, Wash. *See* Tacoma Harbor.
Commissioned officers. *See* Corps of Engineers.
Commissions (*see also* Boards):
  California Débris Commission........ 905
  Mississippi River Commission........ 909
  Permanent International Commission of Congresses of Navigation........ 910
Compton Creek, N. J., improvement of........ 174, 181
Conecuh River, Ala., improvement of........ 403
Coney Island channel, N. Y., improvement of........ 155
Congaree River, S. C.:
  Improvement of........ 323, 326
  Operating and care of lock and dam........ 329
Congresses of Navigation, Permanent International Commission of........ 910
Conneaut Harbor, Ohio, improvement of........ 795
Connecticut River, Mass. and Conn.:
  Improvement between Hartford, Conn., and Holyoke, Mass........ 103
  Improvement below Hartford, Conn........ 104
  Survey between Hartford, Conn., and Holyoke, Mass........ 100
Contentnia Creek, N. C., improvement of........ 293
Contingencies of rivers and harbors, estimate of appropriation for........ 28, 904
Contingencies, Engineer Department, Philippine Islands........ 27
Continuing contracts:
  Ahnapee (Algoma) Harbor, Wis........ 690
  Algoma Harbor, Wis........ 690
  Allegheny River, Pa., locks and dams........ 618
  Ambrose channel, New York Harbor, N. Y........ 159
  Ann, Cape, Mass., Sandy Bay, harbor of refuge. *See* Sandy Bay, *infra.*
  Appomattox River, Va........ 279
  Appropriations, estimate for........ 28, 29
  Aransas Pass, Tex........ 493
  Aransas Pass, Tex., to Corpus Christi, channel from........ 488
  Arthur Kill, N. Y. and N. J........ 168
  Ashtabula Harbor, Ohio........ 794
  Back Cove, Portland, Me. *See* Portland Harbor, *infra.*
  Baltimore Harbor, Md., Patapsco River and channel to........ 224
  Bay Ridge channel, New York Harbor, N. Y........ 162
  Beaufort Inlet, N. C., to Pamlico Sound, waterway........ 298
  Bee Tree shoals, Tennessee River, Ala........ 595
  Big Sandy River, W. Va. and Ky........ 638
  Biscayne Bay, Fla........ 368
  Black Lake Harbor, Holland, Mich. *See* Holland Harbor, *infra.*
  Black River (Lorain) Harbor, Ohio. *See* Lorain Harbor, *infra.*
  Black Rock Harbor, Buffalo, N. Y........ 804
  Black Rock Harbor, Buffalo, N. Y., Lake Erie entrance........ 802
  Black Warrior River, Ala., above Tuscaloosa........ 414
  Black Warrior River, Ala., below Tuscaloosa........ 414, 415
  Boston Harbor, Mass........ 60
  Brazos River, Tex., at mouth........ 492
  Brazos River, Tex., Old Washington to Waco........ 503
  Brazos River, Tex., to Galveston, waterway........ 491
  Bridgeport Harbor, Conn........ 114
  Brunswick Harbor, Ga........ 350
  Buffalo Bayou, Tex........ 475
  Buffalo Harbor, N. Y........ 800
  Buffalo Harbor, N. Y., Black Rock Harbor........ 804
  Buffalo Harbor, N. Y., Lake Erie entrance to Erie Basin and Black Rock Harbor........ 802

Continuing contracts—Continued. Page.
Burlington Harbor, Vt 75
Calumet River, Ill. and Ind 713
Cape Ann, Mass., Sandy Bay harbor of refuge. *See* Sandy Bay, *infra*.
Cape Fear River, N. C., at and below Wilmington 311
Cavallo, Pass, Tex., to Aransas Pass, channel from 497
Champlain, Lake, Burlington Harbor, Vt. *See* Burlington Harbor, *supra*.
Chicago Harbor, Ill., Calumet River. *See* Calumet River, *supra*.
Cleveland Harbor, Ohio 789
Colbert shoals, Tennessee River, Ala 595
Cold Spring Inlet, N. J 210
Columbia River, Oreg. and Wash., at the mouth 862
Columbia River, below mouth of Willamette River 859
Columbia River, The Dalles Rapids to Celilo Falls 850
Corpus Christi, Tex., to Aransas Pass, channel from 488
Cumberland River above Nashville, Tenn. (Locks 3–7 and 21) 588
Delaware River, N. J., Pa., and Del 188
Detroit River, Mich 777
Duluth Harbor, Minn 661
East (Ambrose) channel, New York Harbor, N. Y. *See* New York Harbor, *infra*.
Erie Basin, Buffalo, N. Y., Lake Erie entrance 802
Estimate of appropriations for 29
Fairhaven Harbor, Mass 83
Franklin, La., to Mermentau, waterway 451
Galveston and Brazos Canal, Tex 491
Galveston Harbor, Tex 469
Galveston-Brazos River waterway, Tex 491
Galveston-Houston waterway, Tex 475
Gloucester Harbor, Mass 54
Gowanus Bay channels, New York Harbor, N. Y 162
Grays Harbor, Wash 873
Great Lakes, channels in connecting waters of. *See* Northern and Northwestern Lakes, *infra*.
Great Pedee River, S. C 319
Guadalupe River, Tex 489
Hales bar lock, Tennessee River. *See* Tennessee River, *infra*.
Harbor Beach, Mich 768
Hay Lake channel, St. Marys River, Mich 760
Hillsboro Bay, Fla 377
Hilo Harbor, Hawaii 895
Holland Harbor, Mich 730
Honolulu Harbor, Hawaii 894
Houston-Galveston waterway, Tex 475
Huron Harbor, Ohio 785
Illinois and Mississippi Canal, Ill 720
Judith, Point, R. I., harbor of refuge 93
Kalamazoo River, Mich 728
Kennebec River, Me 39
Kentucky River, Ky 641
Levisa Fork, Big Sandy River, Ky 638
Lorain Harbor, Ohio 787
Ludington Harbor, Mich 742
Lynn Harbor, Mass 56
Manitowoc Harbor, Wis 693
Marquette Harbor, Mich 677
Maumee Bay and River, Ohio. *See* Toledo Harbor, *infra*.
Mermentau, La., to Franklin, waterway 451
Michigan Lake-Sturgeon Bay Canal, including harbor of refuge 688
Milwaukee (inner) Harbor, Wis 699
Milwaukee Harbor, Wis., including harbor of refuge 698
Mississippi River, Head of Passes to Ohio River 909
Mississippi River, between Missouri and Ohio rivers 550
Mississippi River, between Missouri River and Minneapolis 554, 560
Mississippi River at Moline, Ill 558
Mississippi River, Plaquemine Bayou, La 445
Mississippi River, between St. Paul and Minneapolis 560
Mississippi River, South Pass 442

Continuing contracts—Continued. **Page.**
  Mississippi River, Southwest Pass.......... 439
  Mobile Harbor, Ala.......... 409
  Moline Harbor, Ill.......... 558
  Monongahela River, W. Va. and Pa.......... 612, 613
  Mormon Channel, San Joaquin River, Cal.......... 827
  Narragansett Bay, R. I.......... 90
  Neches River, Tex., at mouth.......... 498
  Neebish channels, St. Marys River, Mich.......... 760
  Newark Bay, N. J.......... 165
  New Bedford Harbor, Mass.......... 83
  New Haven Harbor, Conn., breakwater construction.......... 110
  New Haven Harbor, Conn., dredging, etc.......... 108
  New London Harbor, Conn.......... 102
  Newport Harbor, R. I.......... 92
  Newtown Creek, N. Y.......... 143
  New York Harbor, N. Y., Ambrose channel.......... 159
  New York Harbor, N. Y., Gowanus Bay channels.......... 162
  Norfolk Harbor, Va.......... 273, 274
  Northern and Northwestern Lakes, channels connecting.......... 931
  Oakland Harbor, Cal.......... 822
  Ohio River, Dams Nos. 2-6.......... 621
  Ohio River, Dams Nos. 8, 11, 13, 18, and 26.......... 627
  Ohio River, Dam No. 37.......... 609
  Osage River, Mo.......... 579
  Oswego Harbor, N. Y.......... 811
  Ouachita River, Ark. and La.......... 515
  Pamlico Sound, N. C., to Beaufort Inlet, waterway.......... 298
  Passaic River, N. J.......... 165
  Pass Cavallo, Tex., to Aransas Pass, channel from.......... 488
  Patapsco River, Md., and channel to Baltimore.......... 224
  Pedee River, S. C. *See* Great Pedee River, *supra.*
  Philadelphia, Pa., Delaware River.......... 189
  Plaquemine Bayou, La.......... 445
  Point Judith, R. I., harbor of refuge.......... 93
  Portland Harbor, Me.......... 41
  Providence Harbor and River, R. I.......... 90
  Rappahannock River, Va.......... 264
  Red Hook channel, New York Harbor, N. Y.......... 162
  Sabine Lake and River, Tex.......... 498
  Sabine Pass, Tex.......... 501
  St. Johns River, Fla., Jacksonville to the ocean.......... 359
  St. Marys River, Mich., at the falls.......... 755
  St. Marys River, Mich., Hay Lake and Neebish channels.......... 760
  St. Michael Canal, Alaska.......... 891
  Sandbeach (Harbor Beach) harbor of refuge, Mich. *See* Harbor Beach, *supra.*
  Sandusky Harbor, Ohio.......... 783
  Sandy Bay, Cape Ann, Mass., harbor of refuge.......... 52
  San Joaquin River, Cal., Stockton and Mormon channels.......... 826
  San Juan Harbor, P. R.......... 897
  San Luis Obispo Harbor, Cal.......... 820
  San Pablo Bay, Cal.......... 825
  San Pedro, Cal., Wilmington inner harbor.......... 818
  San Pedro Bay, Cal., Wilmington outer harbor.......... 816
  Saugatuck Harbor, Mich.......... 728
  Savannah Harbor, Ga.......... 333
  Scott Point, Tennessee River, Ala., lock at Hales bar. *See* Tennessee River, *infra.*
  South Pass, Mississippi River.......... 442
  Southwest Pass, Mississippi River.......... 439
  Staten Island Sound, N. Y. and N. J.......... 169
  Stockton Channel, San Joaquin River, Cal.......... 827
  Sturgeon Bay Canal, Wis., including harbor of refuge.......... 688
  Superior Harbor, Wis.......... 661
  Tacoma Harbor, Wash.......... 880
  Tampa Bay, Fla.......... 376

Continuing contracts—Continued. Page.
Tampa Harbor, Fla., Hillsboro Bay 377
Tennessee River, Ala., Colbert and Bee Tree shoals 595
Tennessee River, Ala., Hales bar lock, near Scott Point 595
Toledo Harbor, Ohio 780
Tombigbee River, Ala., between mouth and Demopolis 416
Trinity River, Tex., locks and dams 506
Tug Fork, Big Sandy River, W. Va. and Ky 638
Turtle Cove channel, Tex 490
Warrior River, Ala., above Tuscaloosa 414
Warrior River, Ala., below Tuscaloosa 415
Washita (Ouachita) River, Ark. and La. *See* Ouachita River, *supra.*
West Galveston Bay and Brazos River Canal, Tex 491
Willamette River, below Portland, Oreg 859
Wilmington, Cal., inner harbor 818
Wilmington, Cal., outer harbor 816
Wilmington, N. C. *See* Cape Fear River, *supra.*
Winyah Bay, S. C 321
Withlacoochee River, Fla 382
Woods Hole channel, Mass 82
Contracts, continuing. *See* Continuing contracts.
Cooper Creek, N. J., improvement of 199
Coosa River, Ga. and Ala.:
Examination and survey at Horseleg shoals 409
Examination and survey for location and construction of Dam No. 5 409
Examination and survey from Wetumpka, Ala., to mouth 409
Improvement above East Tenn., Va. and Ga. R. R. bridge 406
Improvement below East Tenn., Va. and Ga. R. R. bridge 406, 408
Operating and care of locks and dams 408
Coos Bay, Harbor, and River, Oreg.:
Construction of dredge for Oregon coast harbors 844
Improvement of entrance to bay and harbor 840
Improvement of river 842
Coquille River, Oreg., improvement of, including dredge construction 838
Core Creek, N. C., waterway via. *See* Beaufort Inlet.
Corney Bayou, La., improvement of 519, 522
Corps of Engineers:
Civilian assistants to engineer officers 27
Duties 3
Engineer depots 23, 24
Engineer equipment of troops 25
Engineer School and Post, buildings for 945
Officers on duty in Office of the Chief of Engineers 952
Personnel, commissioned, number, distribution, and changes during the year 3, 4
Personnel, commissioned, proposed increase in 7
Pensonnel, noncommissioned, proposed new grades 8
Personnel, proposed increase in battalions 6
Corpus Christi Bay and Harbor, Tex., improvement of channel from Corpus Christi to Aransas Pass via Turtle Cove 490
Cowlitz River, Wash.:
Examination and survey up to Castlerock 871
Improvement of 866
Craft, water. *See* Dredge boats *and* Wrecks.
Crisfield Harbor, Md., improvement of 246
Croatan Sound, N. C., waterway via. *See* Norfolk-North Carolina sounds waterway.
Crockett, Fort, Galveston, Tex., sea wall, embankment, and fill 496
Crooked (Carrabelle) River, Fla. *See* Carrabelle Harbor.
Crystal River, Fla., improvement of 379
Cuba, defenses of Guantanamo Bay 17
Cumberland River, Ky. and Tenn.:
Improvement above Nashville, Tenn 588
Improvement below Nashville, Tenn 585
Operating and care of locks and dams 591
Preliminary report of survey below Nashville, Tenn., for extension of slack-water system 592

Page.

Cumberland Sound, Ga. and Fla.:
- Improvement of........ 355
- Improvement of waterway between Savannah and Fernandina........ 353

Current River, Ark. and Mo., improvement of........ 542, 543

Currituck Sound, N. C., waterway via. *See* Norfolk—Albemarle Sound waterway.

Curtis Bay, Baltimore, Md.:
- Harbor lines in........ 910
- Improvement of channel to........ 227

Cuyahoga River, Ohio. *See* Cleveland Harbor.

Cypress Bayou, Tex. and La., improvement of, including connecting lakes between Shreveport, La., and Jefferson, Tex........ 507

Cypress Top Outlet, Choctawhatchee River, Fla. *See* Choctawhatchee River.

D.

Dalecarlia reservoir, Washington Aqueduct, D. C. *See* Washington.

Dams. *See* Canals, Rivers and Harbors, *and* Waterways.

D'Arbonne Bayou, La., improvement of........ 519, 522

Darien Harbor, Ga., improvement of........ 341

Dead Horse Inlet, N. Y., examination and survey of waters having outlet in.. 158

Débris, mine, in California. *See* California Débris Commission.

Deep Creek Branch, Elizabeth River, Va., waterway via. *See* Norfolk-North Carolina sounds waterway.

Defenses, seacoast. *See* Fortifications.

Delancey Cove, N. Y. *See* Larchmont Harbor.

Delaware Bay and River, N. J., Pa., and Del.:
- Bordentown bar, improvement of........ 194
- Defenses of........ 10
- Delaware Breakwater, Del., maintenance and repair of........ 196
- Examination of river at and near mouth of Neversink River, N. Y., in connection with examination of the Neversink........ 198
- Harbor lines at Philadelphia, Pa........ 910
- Harbor of refuge in bay, construction of........ 196
- Improvement of river........ 188
- Lewes, Del., iron pier. *See* Lewes.
- Marcushook, Pa. *See* Marcushook.
- Perriwig bar, improvement of........ 193
- Philadelphia and Camden harbors, improvement of........ 189
- Sewer shoal, near Trenton, N. J........ 194
- Wrecks in........ 198

Delaware Capes, N. J., wreck off........ 224

Departments, Executive, Washington, D. C., telegraph line. *See* Public buildings and grounds.

Depots, engineer........ 23

Derelicts. *See* Wrecks.

Deschutes River, Wash. *See* Olympia Harbor.

Des Moines Rapids Canal and dry dock, Mississippi River, operating and care.. 558

Des Plaines River, Ill., survey for 14-foot waterway via, including report on water power and land drainage. *See* Chicago Harbor.

Detroit River, Mich.:
- Improvement of........ 777
- Improvement of channels in waters connecting Great Lakes........ 753
- Surveys, etc. *See* Northern and Northwestern Lakes.

Dickinson Bayou, Tex., improvement of........ 483

Disappearing gun carriages. *See* Fortifications.

Discharge measurements. *See* Water levels.

Dismal Swamp Canal, Va. and N. C., waterway via. *See* Norfolk-North Carolina sounds waterway.

District of Columbia. *See* Washington.

Dividing Creek (La Trappe River), Md. *See* La Trappe River.

Division engineers........ 29

Divisions, engineer........ 29

Doboy bar, Ga., improvement of........ 341, 342

Dock lines, establishment of........ 910

Dog Island Harbor, St. George Sound, Fla. *See* Carrabelle Harbor.

Dog River, Miss. (*see* Pascagoula River)........ 425

Dolphins, building of........ 920

Page.

- Dominion of Canada:
  - Commerce through St. Marys Falls Canal, Ont. 759
  - Transmission of electrical power into United States at Niagara Falls 939, 941
- Dorchester Bay, Mass., improvement of 67
- Double Bayou, Tex., improvement of 479
- Dover, Del., examination and survey of St. Jones River up to 224
- Drawbridges:
  - *See also* Bridges.
  - Rules for opening of 911
- Drawings. *See* Maps.
- Dredge boats:
  - Columbia River, Oreg. and Wash., mouth to Willamette River 859
  - *Gillespie*, east shore Lake Michigan harbors 753
  - Mississippi coast harbors 438
  - New York Harbor, N. Y 158
  - Oregon coast harbors 844
  - Pensacola Harbor, Fla 400
  - Savannah Harbor, Ga 333
  - Seagoing hydraulic, performances of 899
  - Washington State coast harbors 806
  - Willamette River, Oreg., below Portland 859
- Duck Creek (Smyrna River), Del. *See* Smyrna River.
- Duck Island Harbor, Conn., construction of harbor of refuge 106
- Duluth Canal and Harbor, Minn.:
  - Channels in waters connecting Great Lakes, improvement of 753
  - Harbor lines in front of Minnesota Point 911
  - Improvement of 661
  - Regulations governing navigation of 911
- Dunkirk Harbor, N. Y., improvement of 798
- Dutch Island Harbor, R. I. *See* Narragansett Bay.
- Duwamish River, Wash., improvement of. *See* Puget Sound and tributaries.

E.

- Eagle Harbor, Green Bay, Wis., wreck at 706
- East Bay Bayou, Tex., improvement of 479
- East (Ambrose) channel, New York Harbor, N. Y. *See* New York Harbor.
- East Chester Creek, N. Y.:
  - Examination and survey 158
  - Improvement of 129, 130
  - Wreck in 157
- Eastern Bay, Md. *See* Claiborne Harbor.
- Eastern Branch (Anacostia River), D. C. *See* Anacostia River.
- Eastern Branch, Elizabeth River, Va. *See* Elizabeth River.
- East Norwalk Harbor, Conn. *See* Norwalk Harbor.
- East Pass, Carrabelle Harbor, Fla. *See* Carrabelle Harbor.
- East River, Ga. *See* Brunswick Harbor.
- East River, N. Y.:
  - Examination and survey between North Brother and South Brother islands. 157
  - Improvement of 139
  - Resurvey of East River and Hell Gate, N. Y 158
  - Wreck in 157
- East Twin River, Wis. *See* Two Rivers Harbor.
- Echo Bay Harbor, New Rochelle, N. Y.:
  - Examination and survey 158
  - Improvement of 127
- Eel River, Mass. *See* Plymouth Harbor.
- Electrical power:
  - Niagara River, N. Y., control and regulation of 939
  - Tennessee River, Elk River shoals to Florence, Ala 595, 600
- Elizabeth River, N. J., improvement of 174, 180
- Elizabeth River, Va.:
  - Improvement of Norfolk Harbor and its approaches, including Hospital Point and Eastern and Southern branches 273, 274
  - Improvement of waterway to Albemarle Sound, via Currituck Sound 284
  - Improvement of waterway to sounds of North Carolina, via Pasquotank River 282
  - Improvement of Western Branch 276

Elk Point, S. Dak. *See* Missouri River. Page.
Elk River, Md., improvement of........ 229
Elk River Shoals Canal, Ala. *See* Tennessee River.
Elwood, Kans., improvement of Missouri River at........ 29, 577, 578
Embankments. *See* Fortifications.
Emplacements. *See* Fortifications.
Employees, civilian assistants to engineer officers........ 27
Endicott Board........ 10
Engineer depots........ 23
Engineer divisions........ 29
Engineer officers, civilian assistants to........ 27
Engineer Post and School, Washington, D. C., buildings for........ 945
Engineer troops:
  Equipment of........ 25
  New engineer battalions........ 7
Engineers, Boards, etc., of. *See* Boards *and* Commissions.
Engineers, Corps of. *See* Corps of Engineers.
Engineers, division........ 29
Engineers, Office of the Chief of, officers on duty........ 952
Engineers, The Board of........ 10
Equipment, engineer, of troops........ 25
Erie Basin, Buffalo, N. Y.:
  Improvement of Buffalo entrance........ 803
  Improvement of Lake Erie entrance........ 802
Erie Harbor, Pa., improvement of........ 797
Erie Lake:
  See Northern and northwestern lakes.
  Wreck in........ 780
Escambia River, Fla., improvement of........ 403
Esopus Creek, N. Y. *See* Saugerties Harbor.
Essex River, Mass., improvement of........ 51
Estero Bay, Fla., examination and survey........ 385
Estherville-Minim Creek Canal, S. C., improvement of........ 323, 326
Estimates of appropriations required:
  Fortifications........ 23
  Rivers and harbors, etc........ 29, 904
Eureka, Cal. *See* Humboldt Harbor.
Everett Harbor, Wash., improvement of........ 884
Examinations of rivers and harbors:
  Estimate of appropriation for........ 28, 904
  Reports under act of 1909........ 28
Executive departments, Washington, D. C., telegraph line. *See* Public buildings and grounds.
Executive mansion and office, Washington, D. C. *See* Public buildings and grounds.
Expenditures:
  Fortifications........ 20, 21, 22
  Rivers and harbors........ 28, 29
  Under section 14 of the river and harbor act of March 3, 1909........ 30

F.

Fairhaven Harbor, Mass., improvement of........ 83
Fairport Harbor, Ohio, improvement of........ 792
Fairy (Caddo) Lake, Tex. and La. *See* Cypress Bayou.
Falia, Bogue, La., improvement of........ 454, 455
Falls of Ohio River, Louisville, Ky. *See* Ohio River.
Feather River, Cal.:
  See also California Débris Commission.
  Examination of, from the mouth to Marysville........ 834
  Improvement of........ 835
Fernandina Harbor, Fla.:
  See also Cumberland Sound.
  Examination and survey of waterway to Savannah, Ga........ 358
  Improvement of........ 357
  Improvement of waterway to Savannah, Ga........ 353
Ferry (Caddo) Lake, Tex. and La. *See* Cypress Bayou.

Page.
Fifteen-foot rock, San Francisco Harbor, Cal., examination and survey 834
Filtration plant, Washington Aqueduct, D. C. *See* Washington.
Finders, range and position. *See* Fortifications.
Finns Point, Delaware River, wreck near 198
Fire control at fortifications. *See* Fortifications.
Fishing Creek, N. C., improvement of 290
Fish traps, or weirs:
  In Puget Sound, Wash., inspection, etc., of 879
  Permits for construction of 920
Fivemile Bayou, Ark., survey of Blackfish Bayou 548
Fivemile River Harbor, Conn., improvement of 118
Flag River, Wis. *See* Port Wing Harbor.
Flat Lake, La. *See* Grand River.
Flint River, Ga., improvement of 394
Florida, water hyacinths in 383
Florida East Coast Railway Co., basin at Miami, Fla. *See* Biscayne Bay.
Flushing Bay, N. Y.:
  Improvement of 132, 136
  Wreck in 157
Fond du Lac Harbor, Wis. *See* Fox River.
Foreign possessions. *See* Alaska *and* Insular possessions.
Fore River, Portland, Me. *See* Portland Harbor.
Fore (Weymouth) River. Mass. *See* Weymouth River.
Forked Deer River, Tenn., improvement of 582, 583
Fort Caswell, N. C., wrecks near 315
Fort Crockett, Galveston, Tex., sea wall, embankment, and fill 496
Fortificationa:
  Appropriations 11
  Batteries 10, 11, 12
  Batteries in insular possessions 17
  Board of Engineers, The 10
  Board on Fortifications or other Defenses (Endicott Board) 10
  Electrical installations 13
  Electrical installations, insular possessions 18
  Emplacements, modernizing the older 13
  Estimates of appropriations required 23
  Fire control 13
  Fire control at batteries in insular possessions 18
  General statement and progress of work 10
  National Coast Defense Board 10
  Preservation and repair of 14
  Preservation and repair of torpedo structures 17
  Preservation and repair of fortifications, insular possessions 18
  Preservation and repair of torpedo-defense structures in insular possessions 19
  Projects 10
  Repairs and protection at defenses of Charleston, Pensacola, Mobile, and New Orleans 15
  Reserve lights 16
  Searchlights 14
  Searchlights, insular possessions 18
  Sea walls and embankments 16
  Sea walls, defenses of Galveston, Tex 16
  Sites 14
  Sites, insular possessions, procurement of 18
  Submarine mines 17
  Submarine mines, insular possessions 18
  Supplies for seacoast defenses 15
  Supplies for seacoast defenses, insular possessions 19
Fort Leavenworth, Kans., engineer depot 24, 26
Fort Mason, Cal., engineer depot 24, 25, 26
Fort Mott, N. J., wreck off 198
Fort Pierre, S. Dak. *See* Missouri River.
Fort Point channel, Boston, Mass. *See* Boston Harbor.
Fort Riley Military Reservation, Kans., examination for protection of bank line of Republican River in front of 582

Page.
Fort Snelling, Minn., bridge across Mississippi River to St. Paul 948
Fox River, Wis.:
  Improvement of 704
  Improvement below Depere, including Green Bay Harbor 687
  Operating and care of locks and dams 706
Frankfort Harbor, Mich., improvement of 749
Franklin, La., improvement of waterway to Mermentau 451
French Broad River, Tenn., improvement of 601

G.

Gaging. *See* Gauging.
Galena River, Ill.:
  Operating and care of lock and dam 560
  Regulations to govern operation of drawbridges 912
Galleries, cable. *See* Fortifications.
Galveston and Brazos Canal, Tex.:
  Improvement of 491
  Operating and care 491
Galveston Bay and Harbor, Tex.:
  Construction of sea wall, embankment, and fill at Fort Crockett and of sea wall from Thirty-ninth to Forty-fifth streets 496
  Defenses of 10, 16
  Improvement of channel across Hanna reef, Ladies Pass 479
  Improvement of Galveston channel from inner bar to Fifty-sixth street 471
  Improvement of Galveston-Texas City channel 478
  Improvement of harbor entrance 469
  Improvement of Port Bolivar channel 474
  Improvement of waterway to Brazos River 491
  Improvement of waterway to Houston 475
  Improvement of West Bay 478
  Operating and care of Morgan Canal 477
Gasconade River, Mo., improvement of 580
Gascondy, Mo. *See* Gasconade River.
Gauging:
  Columbia River, Oreg. and Wash 870
  Hydrological observations, Ottertail Lake and River and Red Lake and Red Lake River, Minn., and Big Stone Lake and Lake Traverse, Minn. and S. Dak 573
  Michigan Lake, variations in surface level on east shore 723
  Mississippi River and principal tributaries 573
  Northern and northwestern lakes, level 939
Gedney channel, New York Harbor, N. Y. *See* New York Harbor.
Genesee River, N. Y. *See* Charlotte Harbor.
George Lake, St. Johns River, Fla. *See* Volusia bar.
Georgetown Harbor, D. C. *See* Washington.
Georgetown Harbor, S. C. *See* Winyah Bay.
Gladstone Harbor, Mich., improvement of 684
Glencove Harbor, N. Y., improvement of 132, 135
Gloucester Harbor, Mass.:
  Examination and survey 78
  Improvement of 54
Gosport Harbor, N. H. *See* Isles of Shoals Harbor.
Government Printing Office, Washington, D. C., telegraph line. *See* Public buildings and grounds.
Government telegraph line, Washington, D. C. *See* Public buildings and grounds.
Governors Island, New York Harbor, N. Y., enlargement of, etc 163
Gowanus Bay, N. Y., improvement of 162
Granby, S. C. *See* Congaree River.
Grand Calumet River, Ill. and Ind. *See* Calumet River.
Grand Haven Harbor, Mich., improvement of 732
Grand Lake, Mermentau River, La. *See* Mermentau River.
Grand Marais, Mich., improvement of harbor of refuge 681
Grand Marais, Minn., improvement of harbor 658
Grand Rapids, Wabash River, lock and dam. *See* Wabash River.
Grand River, La., improvement of 445

Page.

Grand River, Mich.:
  See also Grand Haven Harbor.
  Improvement of.. 734
Grand River, Ohio. *See* Fairport Harbor.
Grand View, N. Y. *See* Hudson River.
Grays Harbor, Wash.:
  Improvement of, entrance.. 873
  Improvement of, between Aberdeen and the entrance, including dredge construction.. 875
Grays River, Wash., improvement of.. 869
Great Kanawha River, W. Va. *See* Kanawha River.
Great Lakes. *See* Northern and Northwestern Lakes.
Great Pedee River, S. C.:
  Examination and survey from Georgetown to Pedee Station.............. 333
  Improvement of.. 319
  Wreck in.. 333
Great Salt Pond, Block Island, R. I., improvement of........................ 98
Great Sodus Bay, N. Y., improvement of harbor........................ 808
Great South Bay, N. Y., improvement of........................ 146
Green Bay Harbor, Wis.:
  Improvement of.. 687
  Wreck at Eagle Harbor.. 706
Green Jacket shoal, Providence River, R. I., removal of........................ 91
Green River, Ky.:
  Improvement above mouth of Big Barren River........................ 655
  Operating and care of locks and dams........................ 656
Greenwich Harbor, Conn., improvement of........................ 118, 122
Grounds, public, District of Columbia........................ 929
Guadalupe River, Tex., improvement of, from Victoria to Aransas Pass—Pass Cavallo channel........................ 489
Guantanamo Bay, Cuba, defenses of........................ 17
Gulf of Mexico, survey for 14-foot waterway to St. Louis, Mo., and Lockport (Chicago), Ill., including report on water power and land drainage......... 908
Gulfport Harbor, Miss.:
  Diversion of improvement funds to construction of dredge for coast harbors. 438
  Improvement of channel to Ship Island Harbor........................ 432
Gull Lake, Minn., reservoir dam. *See* Mississippi River reservoirs.
Gun batteries. *See* Fortifications.
Gut, The, Lake Champlain, Vt. *See* Champlain Lake.

H.

Hales bar, Tennessee River, lock and dam. *See* Tennessee River.
Half Moon shoal, Nantucket Sound, Mass., wreck in........................ 100
Hampton Roads, Va.:
  Construction of piers and dredging at Jamestown Exposition grounds...... 271
  Defenses of.. 10
  Improvement of.. 277
  Improvement of approaches to Norfolk Harbor........................ 273, 274
  Wreck in.. 288
Handkerchief shoal, Nantucket Sound, Mass., wreck in........................ 99
Hanna reef, Ladies Pass, Tex., improvement of channel........................ 479
Harbor Beach, Mich., improvement of harbor of refuge........................ 768
Harbor Cove, Gloucester, Mass. *See* Gloucester Harbor.
Harbor lines, establishment of........................ 910
Harbors and rivers. *See* Rivers and harbors.
Harlem (Bronx) Kills, N. Y. *See* Harlem River.
Harlem River, N. Y., improvement of........................ 141
Harligen, Tex., examination and survey of Arroyo Colorado to Point Isabel, on Laguna Madre........................ 497
Harlowe Creek, N. C., waterway via. *See* Newbern-Beaufort waterway.
Havre de Grace, Md. *See* Susquehanna River.
Hawaiian Islands:
  Defenses of.. 17, 18, 19
  Hilo Harbor, improvement of........................ 895
  Honolulu Harbor, improvement of........................ 894
  Honolulu Harbor, reclamation of Quarantine Island........................ 895
  Pearl Harbor, improvement of........................ 893

Hay Lake channel, St. Marys River, Mich.: Page.
  Improvement of 760
  Improvement of channels in waters connecting Great Lakes 753
Hell Gate, East River, N. Y. *See* East River.
Hempstead Harbor (north shore of Long Island), N. Y. *See also* Glencove Harbor.
Hennepin Canal, Ill. *See* Illinois and Mississippi Canal.
Highway bridges, Potomac River, Washington, D. C.:
  Aqueduct Bridge 921
  Replacing Long Bridge 921
Highways. *See* Roads.
Hillsboro Bay and River, Fla.:
  Examination and survey of bay from turning basin to head of the estuary toward Ybor 385
  Improvement of 377
  Regulations governing navigation of 911
  Wrecks at Tampa 384, 385
Hilo Harbor, Hawaii, improvement of 895
Hingham Harbor, Mass., improvement of 70
Hiwassee River, Tenn., improvement of 602, 603
Holland Harbor, Mich., improvement of 730
Holmes River, Fla., improvement of 398
Holston River, Tenn., improvement of 602, 605
Homochitto River, Miss., improvement of 464
Honolulu Harbor, Hawaii:
  Defenses of 17, 18, 19
  Improvement of 894
  Reclamation of Quarantine Island 895
Hookton, Cal. *See* Humboldt Harbor.
Hoquarten Slough, Oreg. *See* Tillamook Bay.
Horn Island Harbor and Pass, Miss.:
  Improvement of harbor (*see* Pascagoula River) 425, 427
  Improvement of pass 430
Horseleg shoals, Coosa River, Ga., examination and survey 409
Horseshoe shoal, Nantucket Sound, Mass., wreck on 100
Hospital Point, Norfolk Harbor, Va., removal of 274
Housatonic River, Conn.:
  See also Milford Harbor.
  Improvement of 113
Houston, Tex., waterway to Galveston. *See* Galveston Bay and Harbor.
Howard University reservoir, Washington Aqueduct, D. C. *See* Washington.
Hudson River, N. Y.:
  See also New York Bay and Harbor.
  Harbor lines at Troy 910
  Improvement of 148
  New York Harbor, reef off Pier A. *See* New York Harbor.
  Peekskill Harbor. *See* Peekskill Harbor.
  Rondout Harbor. *See* Rondout Harbor.
  Saugerties Harbor. *See* Saugerties Harbor.
  Stonehouse bar, New Baltimore, removal of 148
  Tarrytown Harbor. *See* Tarrytown Harbor.
  Wrecks in 157
Humboldt Bay and Harbor, Cal., improvement of 832
Huntington Harbor, N. Y., improvement of 132, 134
Huron Harbor, Ohio, improvement of 785
Huron Lake:
  See also Northern and Northwestern Lakes.
  Wreck off Lexington, Mich 780
Hutchinson River (East Chester Creek), N. Y. *See* East Chester Creek.
Hyacinths, water, removal of:
  From Florida waters 383
  From Louisiana waters 466
  From Texas waters 477
Hyannis Harbor, Mass., improvement of 78
Hydraulic mining in California. *See* California Débris Commission.
Hydraulic seagoing dredges, performances of 899
Hydraulics. *See* Water levels.
Hydrology. *See* Water levels.

I.

Illinois and Mississippi Canal, Ill.: Page.
  Construction of, with descriptive and historical sketch.................... 720
  Improvement of pool between Locks 29 and 35, Rock River.............. 559
  Operating and care... 559, 722
Illinois River, Ill.:
  Improvement of (below Copperas Creek).............................. 718
  Improvement of (Copperas Creek to La Salle).......................... 719
  Operating and care of locks and dams.................................. 720
  Operating snag boats and dredge boats................................. 553
  Survey for 14-foot waterway from Lockport (Chicago), Ill., to St. Louis, Mo., and mouth of the Mississippi, including report on water power and land drainage.. 908
Indiana chute, Falls of Ohio River, improvement of......................... 645
Indiana Harbor, Ind., examination and survey................................ 718
Indian River, Fla.:
  Examination of, Fort Pierce to Sewalls Point.............................. 386
  Improvement of.. 366
"Inland Route" and connecting waters between Cheboygan and Conway, Mich., to govern floating of loose logs.. 912
Inland waterways. *See* Canals *and* Waterways.
Inside routes. *See* Canals *and* Waterways.
Insular possessions:
  See also Alaska.
  Defenses of... 17, 18, 19
  Hilo Harbor, Hawaii, improvement of.................................... 895
  Honolulu Harbor, Hawaii, improvement of................................ 894
  Honolulu Harbor, Hawaii, reclamation of Quarantine Island............. 895
  Pearl Harbor, Hawaii, improvement of.................................. 893
  Porto Rico, erection of structures in navigable waters of.................. 912
  San Juan Harbor, P. R., improvement of................................. 897
International Commission, Permanent, of Congresses of Navigation........... 910
Invincible rocks, San Francisco Harbor, Cal., examination and survey........ 834
Isabel, Point, Tex., examination and survey of Arroyo Colorado from Harlingen to, on Laguna Madre... 497
Island End River, Mass. *See* Mystic River.
Island possessions. *See* Insular possessions.
Isles of Shoals Harbor, Me. and N. H.:
  Examination and survey.. 48
  Improvement of.. 45
Istokpoga Creek, Fla. *See* Kissimmee River.

J.

Jacksonville, Fla.:
  See also St. Johns River.
  Improvement of St. Johns River opposite.............................. 362
Jacksonville, N. C., examination and survey of New River up to............. 315
Jamaica Bay, N. Y., examination and survey, including entrance at Rockaway Inlet and waters having outlet in Dead Horse Inlet......................... 158
James River, Va.:
  See also Hampton Roads.
  Construction of permanent landing pier at Jamestown Island.............. 271
  Improvement of.. 269
  Wrecks near Newport News.. 288
Jamestown Exposition, Va., construction of piers and dredging in connection with... 271
Jamestown Island, James River, Va. *See* James River.
Jefferson, Tex. *See* Cypress Bayou.
Jekyl Creek, Ga., waterway via. *See* Savannah-Fernandina waterway.
Johnsons Bayou, La., improvement of.................................... 497
Johnsons Creek, or River, Conn. *See* Bridgeport Harbor.
Jordan River, Miss., improvement of..................................... 434
Judith, Point, R. I.:
  Construction of harbor of refuge...................................... 93
  Examination of harbor of refuge, with plan and estimate for improvement. 100
  Improvement of pond entrance....................................... 96

K.

Kalamazoo River, Mich.: Page.
Improvement of.......... 728
Regulations to govern operation of drawbridge over, between Douglas and Saugatuck, Mich.......... 912
Kampsville lock and dam, Illinois River, Ill. *See* Illinois River.
Kanawha River, W. Va.:
Improvement of.......... 635
Operating and care of locks and dams.......... 635
Karquines (Carquinez) Strait, Cal., examination and survey from San Francisco Bay to Stockton, including.......... 834
Kennebec River, Me.:
Defenses of.......... 10
Improvement of.......... 39
Kenosha Harbor, Wis., improvement of.......... 702
Kentucky River, Ky.:
Improvement of.......... 641
Operating and care of locks and dams.......... 643
Keokuk (Des Moines Rapids) Canal and dry dock, Mississippi River. *See* Mississippi River.
Kewaunee Harbor, Wis., improvement of.......... 691
Keweenaw Bay-Lake Superior waterway, Mich., improvement and care..... 674, 677
Keweenaw Canal, Mich. *See* Keweenaw Bay-Lake Superior waterway.
Keweenaw Point waterway, Mich. *See* Keweenaw Bay-Lake Superior waterway.
Keyport Harbor, N. J., improvement of.......... 174
Key West Harbor, Fla.:
Defenses of.......... 10
Improvement of.......... 369
Kill van Kull, N. Y. and N. J., improvement of Staten Island-New Jersey channel.......... 169
King County, Wash. *See* Puget Sound-Lake Washington waterway.
Kings Mountain battle ground, S. C., erection of monument.......... 950
Kingston, R. I. *See* Point Judith Harbor and Pond.
Kinnikinnick River, Wis. *See* Milwaukee Harbor.
Kissimmee Lake and River, Fla., improvement of.......... 370
Kuhului Harbor, Hawaii, harbor lines established.......... 911

L.

La Conner, Wash. *See* Swinomish Slough.
Lafayette, La., examination and survey of Bayou Vermilion to.......... 469
Lafourche Bayou, La., improvement of.......... 465
Lagrange Bayou, Fla. *See* Holmes River.
Lagrange lock and dam, Illinois River, Ill. *See* Illinois River.
Laguna Madre, Tex., examination and survey from Harlingen, on Arroyo Colorado, to Point Isabel.......... 497
Lakes, Great. *See* Northern and Northwestern Lakes.
Lake Survey. *See* Northern and Northwestern Lakes.
Lake Washington Canal, Wash. *See* Washington Lake.
L'Anguille River, Ark., improvement of.......... 545, 546
Larchmont Harbor, N. Y., improvement of.......... 127
La Trappe River, Md., improvement of.......... 231, 240
Lavaca Bay, Tex., examination and survey of channel from Pass Cavallo to Port Lavaca.......... 497
Leaf River, Miss., improvement of.......... 427, 428
Leavenworth, Fort, Kans., engineer depot.......... 26
Leech Lake, Minn. *See* Mississippi River reservoirs.
Lee Slough, Apalachicola River, Fla. *See* Apalachicola River.
Lemon Creek, N. Y. (*see* Staten Island-New Jersey channel).......... 169
Leonardtown Harbor, Md. *See* Breton Bay.
Levels, water. *See* Water levels.
Levisa Fork, Big Sandy River, Ky., improvement of.......... 638
Lewes, Del., iron pier in Delaware Bay, maintenance and repair.......... 195
Lewis River, Wash., improvement of.......... 866, 867
Life-saving exhibit, Jamestown Exposition, Va., dredging of Bush Creek for accommodation of.......... 271
Little Annemessex River, Md. *See* Crisfield Harbor.
Little Bay de Noc, Mich. *See* Gladstone Harbor.

Page.

Little Black River, Ark. and Mo., examination of ... 548
Little D'Arbonne Bayou, La. *See* D'Arbonne Bayou.
Little Harbor, Woods Hole, Mass. *See* Woods Hole Harbor.
Little Harbor, N. H., improvement of harbor of refuge ... 47
Little Kanawha River, W. Va.:
  Improvement of ... 631
  Operating and care of locks and dams ... 634
Little Mud River, Ga., waterway via. *See* Savannah-Fernandina waterway.
Little Narragansett Bay, R. I. and Conn. *See* Pawcatuck River.
Little Pass, Soda Lake, La. *See* Cypress Bayou.
Little Pedee River, S. C., improvement of ... 315, 317
Little Pigeon River, Tenn., improvement of ... 601
Little River (part of Red River), La. *See* Red River below Fulton.
Little Sarasota Bay, Fla. *See* Sarasota Bay.
Little Sodus Bay., N. Y., improvement of harbor ... 809
Little Tallahatchie River, Miss. *See* Tallahatchie River.
Little Tennessee River, Tenn. *See* Tennessee River above Chattanooga ... 593
Livingstone channel, Detroit River, Mich. *See* Detroit River.
Lockport, Ill., survey for 14-foot waterway to St. Louis, Mo., and mouth of the Mississippi ... 908
Locks. *See* Canals, Rivers and harbors, *and* Waterways.
Log booms, permits for construction of ... 920
Long Bridge, Potomac River, Washington, D. C., highway bridge, replacing ... 923
Long Cove, Me., examination and survey of Penobscot Bay from Macks Point to Cape Jellison ... 48
Long Island Sound, N. Y. and Conn., defenses of eastern entrance ... 10
Long Tom River, Oreg. *See* Willamette River above Portland.
Lorain Harbor, Ohio, improvement of ... 787
Los Angeles River, Cal. *See* Wilmington Harbor.
Louisa, Ky. *See* Big Sandy River.
Louisiana, State of, water hyacinths in ... 466
Louisville, Ky. *See* Louisville and Portland Canal.
Louisville and Portland Canal, Ky.:
  Enlargement of ... 644
  Operating and care ... 649
Lowell, Wash., examination and survey of Snohomish River up to ... 893
Lower Chipola River, Fla., improvement of ... 390
Lubec Channel, Me., improvement of ... 30
Ludington Harbor, Mich., improvement of ... 742
Lumberton Branch, Rancocas River, N. J. *See* Rancocas River.
Lynch River, S. C., improvement of ... 319
Lynn Harbor, Mass., improvement of ... 56

M.

McClellanville, S. C., improvement of waterway to Charleston ... 329
Mackey Creek, N. C.:
  Regulations to govern operation of drawbridge ... 912
  Wreck in ... 288
Maçon Bayou, La., improvement of ... 519, 521
Madre, Laguna, Tex., examination and survey from Harlingen, on Arroyo Colorado, to Point Isabel ... 497
Mail Dock, Bonita channel, San Francisco Harbor, Cal., examination and survey of rocks near ... 834
Main Ship channel, New York Harbor, N. Y. *See* New York Harbor.
Malden River, Mass., improvement of ... 58
Mall, the Washington, D. C. *See* Public buildings and grounds.
Mamaroneck Harbor, N. Y., improvement of ... 126
Manasquan River, N. J., improvement of ... 186
Manatee River, Fla., improvement of ... 375
Manchac Bayou, La., improvement of ... 454, 458
Mandeville, La. *See* Pontchartrain Lake.
Manhattan Borough, N. Y. *See* New York Harbor.
Manila Bay, Philippine Islands, defenses of ... 17, 18, 19
Manistee Harbor and River, Mich., improvement of harbor ... 744
Manistique Harbor, Mich., improvement of ... 683

Manitowoc Harbor, Wis.: **Page.**
- Improvement of 693
- Harbor lines at Manitowoc 911

Man-of-War Harbor, Fla., wreck in 385
Manokin River, Md., improvement of 231, 241
Mantua Creek, N. J:
- Improvement of 200
- Wreck in 224

Maps and charts:
- Military and other 945
- Northern and Northwestern Lakes 937

Marcushook, Pa., improvement of ice harbor in Delaware River 189, 195
Marquette Bay and Harbor, Mich.:
- Construction of harbor of refuge in bay 679
- Improvement of harbor 677

Marthas Vineyard, Mass. *See* Vineyard Haven Harbor.
Mason, Fort, Cal., engineer depot 24, 25, 26
Massachusetts Bay, Mass. *See* Boston Harbor.
Matagorda Bay, Tex.:
- Examination and survey from Pass Cavallo to Port O'Connor for harbor... 497
- Examination and survey of channel from Pass Cavallo to Port Lavaca..... 497
- Improvement of channel from Pass Cavallo to Aransas Pass 488

Matawan Creek, N. J.:
- *See also* Keyport Harbor.
- Improvement of 174, 176

Mattaponi River, Va., improvement of 256, 257
Mattituck Harbor, N. Y., improvement of 132, 133
Maumee Bay and River, Ohio. *See* Toledo Harbor.
Meherrin River, N. C., improvement of 286
Memorials, statues, etc. *See* Statues, memorials, etc.
Menominee Harbor and River, Mich. and Wis., improvement of 685
Menominee River, Milwaukee, Wis. *See* Milwaukee Harbor.
Mermentau, La. *See* Mermentau River.
Mermentau River, La.:
- Improvement of, including tributaries 460, 462
- Improvement of waterway to Franklin 451

Merrimac River, Mass.:
- *See also* Newburyport Harbor.
- Examination and survey for locks and dams up to Haverhill 78
- Improvement of 50

Mexico, Gulf of, survey for 14-foot waterway to St. Louis, Mo., and Lockport (Chicago), Ill., including report on water power and land drainage 908
Miami, Fla. *See* Biscayne Bay.
Michigan City Harbor, Ind., improvement of 716
Michigan Lake (*see also* Northern and Northwestern Lakes):
- Canal to Sturgeon Bay, improvement of, including harbor of refuge 688
- Canal to Sturgeon Bay, operating and care 690
- Water levels on east shore, variations in 723
- Waterway 14 feet deep from Lockport (Chicago), Ill., to St. Louis, Mo., and the Gulf, survey, including report on water power and land drainage... 908
- Wreck off Thirty-first street 718

Middle Neebish channel, St. Marys River, Mich., improvement of 760
Milan, Ill. *See* Illinois and Mississippi Canal.
Milford Harbor, Conn., improvement of 111
Milford Haven, Va., improvement of harbor at 167
Mill Creek, or River, New Haven, Conn. *See* New Haven Harbor.
Mill Creek, Southport, Conn. *See* Southport Harbor.
Miller Bay, Lake Winnebago, Wis. *See* Fox River.
Mill River, New Haven, Conn. *See* New Haven Harbor.
Mill River, Stamford, Conn. *See* Stamford Harbor.
Milwaukee Bay, Harbor, and River, Wis.:
- Improvement of, including harbor of refuge 698
- Improvement of inner harbor 699

Mines, submarine. *See* Fortifications.
Mingo Creek, S. C., improvement of 323
Minim Creek-Esterville Canal, S. C., improvement of 323, 326

Page.
Mining casemates. *See* Fortifications.
Mining, hydraulic, in California. *See* California Débris Commission.
Minneapolis, Minn. *See* Mississippi River.
Minnesota Point, harbor lines in Duluth-Superior Harbor, Minn. and Wis..... 911
Minnesota River, Minn.:
  Examination of Bois de Sioux River, Lake Traverse, and Big Stone Lake for diversion of waters of Red River of the North into.... 573
  Improvement of.... 568
Mispillion River, Del., improvement of.... 214, 217
Mission Bay Rocks, San Francisco Harbor, Cal., examination and survey...... 834
Mississippi coast, construction of dredge for harbors on.... 438
Mississippi River:
  Brainerd to Grand Rapids, Minn., improvement from.... 562, 564
  Cairo, Ill., to Head of Passes, improvement, surveys, etc.... 909
  Cairo, Ill., to Missouri River, improvement from.... 550
  Cape Girardeau, Mo., to Head of Passes, levees.... 909
  Chicago (Lockport), Ill., to St. Louis, Mo., and the Gulf. *See* St. Louis, *infra.*
  Cubits Gap to Head of Passes, dredging shoals.... 439
  Dams, between St. Paul and Minneapolis. *See* St. Paul, *infra.*
  Des Moines Rapids Canal and dry dock, operating and care.... 558
  Discharge measurements, including tributaries. *See* Gauging, *infra.*
  Dredge and snag boats above Missouri River, operation of.... 553
  Dredge and snag boats below Missouri River, operation of.... 549
  Fort Snelling, Minn., bridge to St. Paul.... 948
  Gauging, including tributaries.... 573
  Grand Rapids to Brainerd, Minn., improvement from.... 562, 564
  Gulf of Mexico to St. Louis, Mo., and Lockport (Chicago), Ill. *See* St. Louis, *infra.*
  Head of Passes to Cape Girardeau, Mo., levees.... 909
  Head of Passes to Cubits Gap, dredging shoals.... 439
  Head of Passes, to headwaters, surveys from.... 444
  Head of Passes to Ohio River, improvement, surveys, etc.... 909
  Illinois and Mississippi Canal, Ill. *See* Illinois and Mississippi Canal.
  Illinois River, survey for 14-foot waterway from Lockport (Chicago), Ill., to St. Louis, Mo., and mouth of the Mississippi, including report on water power and land drainage.... 908
  Keokuk (Des Moines Rapids) Canal and dry dock, operating and care..... 558
  Levees, Head of Passes to Cape Girardeau, Mo.... 909
  Lockport (Chicago), Ill., to St. Louis, Mo., and the Gulf. *See* St. Louis, *infra.*
  Mexico, Gulf of, to St. Louis, Mo., and Lockport (Chicago), Ill. *See* St. Louis, *infra.*
  Michigan Lake to St. Louis, Mo., and the Gulf. *See* St. Louis, *infra.*
  Milan section of Illinois and Mississippi Canal, Ill., operation and care.... 559
  Minneapolis, Minn., to St. Paul, improvement from.... 554, 560
  Minneapolis, Minn., to St. Paul, operating and care of Lock No. 2.... 562
  Missouri River, above, operation of snag and dredge boats.... 553
  Missouri River, below, removal of snags and wrecks.... 549
  Missouri River to Ohio River, improvement from.... 550
  Missouri River to St. Paul, Minn., improvement from.... 554
  Moline, Ill., improvement at.... 558
  Moline, Ill., operating and care of lock.... 559
  Mouth to St. Louis, Mo., and Lockport (Chicago), Ill. *See* St. Louis, *infra.*
  New Orleans, La., defenses of.... 10
  Ohio River to Head of Passes, improvement, surveys, etc.... 909
  Ohio River to Missouri River, improvement from.... 550
  Plaquemine Bayou, La., construction of lock.... 445
  Pokegama Falls, Minn., reservoir dam. *See* Reservoir dams, *infra.*
  Regulations governing navigation of Southwest Pass.... 911
  Reservoir dams at headwaters, construction of.... 562
  Reservoir dams at headwaters, operating and care.... 565
  St. Louis, Mo., survey for 14-foot waterway from Lockport (Chicago), Ill., to the Gulf, including report on water power and land drainage.... 908
  St. Paul, Minn., bridge to Fort Snelling.... 948

Mississippi River—Continued. Page.
  St. Paul, Minn., gauging 573
  St. Paul, Minn., to Minneapolis, improvement from 560
  St. Paul, Minn., to Minneapolis, operating and care of Lock No. 2 562
  St. Paul, Minn., to Missouri River, improvement from 554
  Snag and dredge boats above Missouri River, operation of 553
  Snags and wrecks below Missouri River, removal of 549
  Snelling, Fort, Minn., bridge to St. Paul 948
  South Pass, examinations and surveys 444
  South Pass, maintenance of channel 442
  Southwest Pass, improvement of, including shoals between Cubits Gap and Head of Passes 439
  Vicksburg Harbor, Miss., improvement of 524
  Water-level observations, including tributaries 573, 909
  Wrecks, etc., below Missouri River, removal of 549
Mississippi River Commission:
  Improvement of Mississippi River 909
  Levees, Head of Passes to Cape Girardeau, Mo 909
  Survey for waterway from Lockport, Ill., to St. Louis, Mo., and the Gulf 908
Mississippi Sound, Miss., and Ala.:
  Dredge boat for harbors on coast of Mississippi. *See* Mississippi State.
  Gulfport-Ship Island Harbor channel, and Ship Island Pass. *See* Gulfport Harbor.
  Horn Island Harbor. *See* Pascagoula River.
  Horn Island Pass. *See* Horn Island Pass.
Mississippi, State of, construction of dredge for harbors on coast of 438
Missouri River:
  Contributions from private agencies for improvement at Elwood, Kans. 29, 577, 578
  Examination and survey up to Sioux City, Iowa 582
  Improvement of 573
  Harbor lines at Omaha, Nebr 910
Mobile Bay and Harbor, Ala.:
  Defenses of 10, 15
  Improvement of 409
  Harbor lines at Pinto Island 910
  Improvement of bar at entrance to bay 413
  Removal of sunken dry dock at Mobile 438
Moccasin River (Contentnia Creek), N. C. *See* Contentnia Creek.
Mokelumne River, Cal., improvement of 828
Moline, Harbor, Ill.:
  Improvement of 558
  Improvement of Mississippi River between Missouri River and St. Paul 554
  Operating and care of lock 559
Monongahela River, W. Va. and Pa.:
  Harbor lines from Lock No. 5 to Lock No. 6 911
  Improvement of, in Pennsylvania (at Locks 2, 3, 5, and 6) 613
  Improvement of, in West Virginia (Locks Nos. 8 to 15) 612
  Improvement of Pittsburg Harbor 625
  Operating and care of locks and dams 616
Monroe Harbor, Mich., improvement of 769, 772
Monroe Lake, St. Johns River, Fla. *See* Volusia bar.
Monterey, Cal., monument at 951
Montesano, Wash. *See* Chehalis River.
Monuments, statues, etc. *See* Statues, memorials, etc.
Moore, James A., construction of Puget Sound-Lake Washington Canal by 882
Mooringsport, La. *See* Cypress Bayou.
Morgan Canal, Tex., operating and care 477
Mormon Channel, San Joaquin River, Cal., improvement of 827
Morris Cove, New Haven, Conn., examination and survey 100
Mortar batteries. *See* Fortifications.
Mosquito Creek Canal, S. C. *See* Santee River.
Mott, Fort, N. J., wreck near 198
Mount Desert, Bar Harbor, Me., construction of breakwater 31
Mount Holly Branch, Rancocas River, N. J. *See* Rancocas River.
Mount Hope Bay, Mass. *See* Fall River Harbor.
Mount Rainier National Park, Wash., construction of road 944
Mud Lake, La. *See* Mermentau River.

	Page.
Mud River, Ga. *See* Savannah-Fernandina waterway.	
Mud River, S. C. *See* Savannah-Beaufort waterway.	
Murderkill River, Del., improvement of	214, 216
Muscle Shoals Canal, Tennessee River, Ala.:	
Construction of	595
Operating and care	600
Muscogee (Muskogee), Okla. *See* Muskogee.	
Muskegon Harbor, Mich., improvement of	736
Muskingum River, Ohio:	
Harbor lines at Zanesville, Ohio	911
Improvement of	636
Operating and care of locks and dams	637
Muskogee, Okla., examination of Arkansas River to	548
Mystic River, Mass.:	
Examination and survey	78
Improvement of	57
Improvement of, below mouth of Island End River	59

N.

Nansemond River, Va., improvement of	278
Nanticoke River, Del. and Md., improvement of	243
Nantucket Harbor, Mass., construction of harbor of refuge	79
Nantucket Sound, Mass., wrecks in	99, 100
Napa River, Cal., improvement of	829, 831
Narragansett Bay, R. I.:	
See also Wickford Harbor.	
Defenses of	10
Improvement of	90
Narrows of Lake Champlain, N. Y. and Vt.:	
Improvement of	76
Wreck in	77
Nasel River, Wash. *See* Willapa River.	
Nashville, Tenn. *See* Cumberland River.	
Natalbany River, La. *See* Tickfaw River.	
National Coast Defense Board	10
National Parks. *See* Parks.	
Navesink (North Branch of Shrewsbury) River, N. J. *See* Shrewsbury River.	
Navigable Waters. *See* Bridges, Rivers and harbors, *and* Wrecks.	
Navigation, Congresses of, Permanent International Commission	910
Neches River, Tex., improvement of	498
Neches-Sabine Canal, regulations governing navigation of	911
Neebish channels, St. Marys River, Mich., improvement of	760
Neenah (Fox) River, Wis. *See* Fox River.	
Neponset River, Mass., improvement of	67
Neuse River, N. C.:	
Improvement of	294
Improvement of waterway between Newbern and Beaufort	299
Neversink River, N. Y., examination and survey	198
Newark Bay, N. Y. and N. J. *See* Arthur Kill *and* Passaic River.	
New Baltimore, N. Y. *See* Hudson River.	
New Bedford Harbor, Mass.:	
Defenses of	10
Improvement of	83
Newbern, N. C.:	
See also Neuse *and* Trent rivers.	
Improvement of waterway to Beaufort, N. C	299
Newburyport Harbor, Mass., improvement of	48
New Haven Harbor, Conn.:	
Construction of breakwaters	110
Examination and survey, including Morris Cove	100
Improvement of, by dredging, etc	108
Improvement of West River	108
Wreck in	124
New Jersey-Staten Island channel:	
Harbor lines in Arthur Kill around Buckwheat Island	910
Improvement of	169

Page.
New London Harbor, Conn., improvement of, including Shaws and Winthrop coves ... 102
New Orleans and Northeastern Railroad. *See* Pontchartrain Lake.
New Orleans, battle of, monument to the memory of soldiers who fell in ... 949
New Orleans Harbor, La.:
  Defenses of ... 15
  Improvement of. *See* Mississippi River.
Newport Harbor, R. I., improvement of ... 92
Newport River, N. C.:
  See also Beaufort Harbor.
  Improvement of waterways between Beaufort and New River ... 303
  Improvement of waterway between Newbern and Beaufort ... 299
New River, Fla., examination of ... 386
New River, N. C.:
  Examination and survey up to Jacksonville ... 315
  Improvement of ... 303
  Improvement of waterways to Swansboro and Beaufort ... 303, 304, 306
New Rochelle, N. Y. *See* Echo Bay Harbor.
New Shoreham, Block Island, R. I. *See* Block Island.
Newton, Ala. *See also* Choctawhatchee River.
Newton Creek, N. Y., improvement of ... 143
New Whatcom (Bellingham) Harbor, Wash., improvement of Whatcom Creek waterway ... 887
New York Bay and Harbor, N. Y.:
  Ambrose channel, improvement of, including dredge construction ... 159
  Arthur Kill. *See* Arthur Kill.
  Battery, the, removal of shoal in Hudson River off Pier A ... 158
  Bay Ridge channel. *See* Bay Ridge channel.
  Bayside channel, improvement of ... 158
  Bronx River. *See* Bronx River.
  Brooklyn. *See* East River, Gowanus Bay, and Newton Creek.
  Coney Island channel. *See* Coney Island channel.
  Defenses of ... 10
  Dredges, construction of ... 158
  East (Ambrose) channel. *See* Ambrose channel, *supra*.
  East Chester Creek. *See* East Chester Creek.
  East River. *See* East River.
  Flushing Bay. *See* Flushing Bay.
  Gedney channel, improvement of ... 158
  Governors Island, enlargement of ... 163
  Gowanus Bay. *See* Gowanus Bay.
  Harlem River. *See* Harlem River.
  Hell Gate, East River. *See* East River.
  Hudson (North) River, removal of reef off Pier A ... 158
  Hudson River, wrecks in ... 157
  Hutchinson River (East Chester Creek). *See* East Chester Creek.
  Improvement of, including dredge construction ... 158
  Kill van Kull. *See* Kill van Kull.
  Lemon Creek. *See* Lemon Creek.
  Main Ship channel, improvement of ... 158
  Narrows to the sea, improvement from, including dredge construction ... 158
  Newark Bay. *See* Arthur Kill *and* Passaic River.
  New Jersey-Staten Island channel. *See* New Jersey-Staten Island channel.
  Newtown Creek. *See* Newtown Creek.
  North (Hudson) River. *See* Hudson River, *supra*.
  Red Hook channel. *See* Red Hook channel.
  Red Hook Point, New York Harbor, modification of harbor lines ... 910
  Regulations to govern navigation of ... 160
  Spuyten Duyvil Creek. *See* Spuyten Duyvil Creek.
  Staten Island-New Jersey channel. *See* Staten Island-New Jersey channel.
  Staten Island Sound. *See* Arthur Kill.
  Supervision of ... 904
  Wrecks in ... 164
Niagara Falls, Niagara River, N. Y. *See* Niagara River.

Page.

- Niagara River, N. Y.:
  - Black Rock Harbor and channel, improvement of 804
  - Buffalo Harbor, improvement of 800
  - Control and regulation of waters of, and preservation of the falls 939
  - Erie Basin and Black Rock Harbor, improvement of Buffalo entrance 803
  - Erie Basin and Black Rock Harbor, improvement of Lake Erie entrance 802
  - North Tonawanda to Lake Erie, including Tonawanda Harbor, improvement from 805
  - Surveys, etc. *See* Northern and Northwestern Lakes.
  - Wreck of scow *Trader* off Strawberry Island, removal of 806
- Niobrara River, Nebr., construction of bridge across 948
- Nolin River, Ky. *See* Green River.
- Nomini Creek, Va., improvement of 263
- Noncommissioned officers. *See* Corps of Engineers.
- Nooksak River, Wash., improvement of. *See* Puget Sound and tributaries.
- Noonday rocks, San Francisco Harbor, Cal., examination and survey 834
- Norfolk Harbor, Va.:
  - Improvement of, and approaches, including Hospital Point 273, 274
  - Improvement of waterway to Albemarle Sound, via Currituck Sound 284
  - Improvement of waterway to sounds of North Carolina (to Pamlico Sound) via Pasquotank River 282
  - Improvement of Western Branch, Elizabeth River 276
  - Jamestown Exposition grounds, pier construction and dredging 271
  - Wrecks in 288
- North Branch, Chicago River, Ill. *See* Chicago Harbor and River.
- North Branch, Shrewsbury River, N. J. *See* Shrewsbury River.
- North Brother Island, East River, N. Y., examination and survey between South Brother Island and 157
- North Carolina Cut, N. C., waterway via. *See* Norfolk-Albemarle Sound waterway.
- North Carolina sounds, improvement of waterways to Norfolk, Va 282, 284
- Northeast River, N. C., improvement of 307
- Northern and Northwestern Lakes:
  - Channels in waters connecting, improvement of 931
  - Commercial statistics, Sault Ste. Marie canals, Mich 759
  - Control and regulation of waters of Niagara River, and preservation of Niagara Falls 939
  - Surveys, charts, etc 937
  - Water levels 939
  - Water levels on east shore of Lake Michigan, variations in 723
- North Fork, Forked Deer River, Tenn. *See* Forked Deer River.
- North Fork, Skagit River, Wash. *See* Puget Sound and tributaries.
- North Hero Island channel (The Gut), Lake Champlain, Vt.:
  - Examination and survey 78
  - Improvement of 74
- North Landing River, Va. and N. C., waterway via. *See* Norfolk-Albemarle Sound waterway.
- North (Hudson) River, N. Y. *See* Hudson River, *under* New York Bay and Harbor.
- North River, N. C., waterway via. *See* Norfolk-Albemarle Sound waterway.
- North River, Wash. *See* Willapa River.
- North Tonawanda, N. Y. *See* Tonawanda Harbor.
- Norwalk Harbor, Conn., improvement of 117
- Nyack, N. Y. *See also* Hudson River.

O.

- Oakland Harbor, Cal., improvement of 822
- Obion River, Tenn., improvement of 582
- Occoquan Creek, Va., improvement of 256, 260
- Ocean City, N. J., wreck off 224
- Ocklawaha (Oklawaha) River, Fla. *See* Oklawaha River.
- Ocmulgee River, Ga., improvement of 343, 346
- Oconee River, Ga., improvement of 343, 344
- Oconto Harbor, Wis., improvement of 686
- Office of the Chief of Engineers, officers on duty in 952
- Officers, engineer, civilian assistants to 27
- Officers of the Corps of Engineers. *See* Corps of Engineers.

Page.

Ogdensburg Harbor, N. Y., improvement of 814

Ohio River:
  Falls at Louisville, Ky., improvement at 644
  Harbor lines from Dam No. 3, at Glen Osborne, Pa., to Dam No. 5, near Rochester, Pa 911
  General improvement 606
  Ice piers 606
  Indiana chute, Louisville, Ky., improvement of 645
  Locks and Dams 1–6, operating and care 624
  Locks and Dams 2–7, construction of 621
  Locks and Dams 8, 11, 13, 18, 19, 26, construction of 627
  Lock and Dam 37, construction of 609
  Louisville and Portland Canal, Ky., enlargement of 644
  Louisville and Portland Canal, Ky., operating and care 649
  Pittsburg Harbor, Pa., improvement of 625
  Pools 3, 4, and 6, dredging in 623
  Snag boats, operation of 611

Okanogan River, Wash., improvement of 889

Oklawaha River, Fla., improvement of 365

Oldmans Creek, N. J.:
  Examination and survey 224
  Wreck in 224

Old Tampa Bay, Fla. *See* Tampa Bay.

Olympia Harbor, Wash., improvement of 879

Ontario Lake. *See* Northern and Northwestern Lakes.

Ontonagon Harbor and River, Mich., improvement of 673

Orange Mills flats, St. Johns River, Fla., improvement at 363

Orange River, Fla., improvement of 371

Ordnance. *See* Fortifications.

Oregon, dredging plant for harbors on coast 844

Osage River, Mo., improvement of 579

Oswegatchie River, N. Y. *See* Ogdensburg Harbor.

Oswego Harbor, N. Y., improvement of 811

Ottertail Lake and River, Minn., survey of (hydrological observations) 573

Ouachita River, Ark. and La., improvement of 515

Oyster Creek, Tex., improvement of 478

P.

Pacific coast, monument at Monterey, Cal., to commemorate the taking possession of, by Commodore Sloat 951

Packard rock, San Francisco Harbor, Cal., examination and survey 834

Pagan River, Va., improvement of 278

Pamlico River, N. C., improvement of 291

Pamlico Sound, N. C.:
  Improvement of waterway to Beaufort Inlet 298
  Improvement of waterway to Norfolk, Va 282

Pamunkey River, Va.:
  Improvement of 256, 258
  Wreck in 272

Parks, public:
  District of Columbia, improvement and care 248, 929
  Mount Rainier National Park, Wash., construction of road 944
  Yellowstone National Park, improvement of 942

Pascagoula River, Miss.:
  Improvement above Dog River 427
  Improvement below Dog River 425
  Improvement below Dog River, diversion of funds to construction of dredge for coast harbors 438
  Pasquotank River, N. C., waterway via. *See* Norfolk-North Carolina sounds waterway.

Passaic River, N. J.:
  Examination of 187
  Improvement of 165
  Wreck in 187

Pass Cavallo, Tex.: Page.
Examination and survey of channel to Port Lavaca 497
Examination and survey to Port O'Connor (on Matagorda Bay) for harbor 497
Improvement of channel to Aransas Pass 488
Patapsco River, Md.:
Improvement of, and channel to Baltimore 224
Improvement of channel to Curtis Bay 227
Improvement of harbor at southwest Baltimore (Spring Garden) 228
Patchogue River, N. Y. (*See* Great South Bay) 146
Pawcatuck River, R. I. and Conn., improvement of 100
Pawpaw River, Mich. *See* St. Joseph Harbor.
Pawtucket (Seekonk) River, R. I., improvement of 88
Peace Creek, or River, Fla. *See* Charlotte Harbor.
Pearl Harbor, Hawaii:
Defenses of 17, 18, 19
Improvement of 893
Pearl River, Miss.:
Improvement between Edinburg and Jackson 436
Improvement below Rockport 435
Pedee rivers, S. C. *See* Great Pedee *and* Little Pedee.
Peekskill Harbor, N. Y., improvement of 151, 152
Pend Oreille River, Wash., improvement of 889, 890
Penobscot Bay, Me., examination and survey from Macks Point to Cape Jellison 48
Penobscot River, Me.:
Improvement of 35
Wreck in Bangor Harbor 47
Pensacola Bay and Harbor, Fla.:
Defenses of 15
Improvement of harbor, including dredge construction 400
Pentwater Harbor, Mich., improvement of 738, 740
Pepperell Cove, Me., examination and survey 48
Pequonnock (Poquonock) River, Conn. *See* Bridgeport Harbor.
Pere Marquette Lake, Mich. *See* Ludington Harbor.
Permanent International Commission of Congresses of Navigation 910
Permits:
For construction of bridges 912
For diversion of water from Niagara, River N. Y., and for transmission of electrical power from Canada 939
For erection in Porto Rico of structures other than bridges 912
For erection of structures other than bridges 920
Perquimans River, N. C., improvement of 285
Perriwig bar, Delaware River:
See also Delaware River.
Improvement of 193
Petaluma Creek, Cal., improvement of 829
Petersburg, Va. *See* Appomattox River.
Petoskey Harbor, Mich., improvement of 752
Philadelphia, Pa.:
Improvement of Delaware River at 189
Wreck in Delaware River at 224
Philippine Islands, defenses of 17, 18, 19
Pierhead lines, establishment of 910
Piermont, N. Y. *See* Hudson River.
Pierre, S. Dak. *See* Missouri River.
Pierre, Fort, S. Dak. *See* Missouri River.
Piers:
Construction of, in connection with Jamestown Exposition, Va 271
Permits for construction of 920
Permits for construction of, in Porto Rico 912
Pigeon Bayous, La., improvement of 445
Pike Creek, Wis. *See* Kenosha Harbor.
Pine Bluff, Ark., examination and improvement of Arkansas River at 538, 539, 548
Pine Island Sound, Fla.:
See also Charlotte Harbor.
Examination of 386
Pine Lake and River (Charlevoix Harbor), Mich., improvement of 750
Pine River, Minn. *See* Mississippi River reservoirs.

Page.

Pinto Island, harbor lines in Mobile River 910
Pittsburg Harbor, Pa.:
  See also Allegheny, Monongahela, *and* Ohio rivers.
  Improvement of 625
Plantation Creek, Ga., improvement of 349
Plaquemine Bayou, La., improvement of 445
Plymouth Harbor, Mass.:
  Examination and survey 78
  Improvement of 71
Pocomoke River, Md., improvement of 231, 239
Point Harbor Channel, N. C., examination of 289
Point Isabel, Tex., examination and survey of Arroyo, Colo., from Harlingen to, on Laguna Madre 497
Point Judith Harbor and Pond, R. I.:
  Construction of harbor of refuge 93
  Examination of harbor of refuge, with plan and estimate for improvement. 100
  Improvement of pond entrance 96
Point Pleasant, W. Va., monument marking battle of revolution fought at that place 952
Pokegama Falls, Mississippi River, Minn. *See* Mississippi River reservoirs.
Pollock Rip Slue, Nantucket Sound, Mass., wrecks on and near 99
Ponchatoula River, La. *See* Tickfaw River.
Poquonock River, Conn. *See* Bridgeport Harbor.
Porcupine Island, Bar Harbor, Me., construction of breakwater 31
Portage Lake and Lake Superior canals, Houghton County, Mich. *See* Keweenaw Bay—Lake Superior waterway.
Portage Lake, Manistee County, Mich., improvement of harbor of refuge 746
Portage River, Houghton County, Mich., waterway via. *See* Keweenaw Bay—Lake Superior waterway.
Portage River, Ohio. *See* Port Clinton Harbor.
Port Arthur Canal, Tex.:
  Improvement of (*see* Sabine River) 501
  Operating and care 500
  Regulations governing navigation of 911
Port Bolivar, Tex., improvement of channel to 474
Port Chester Harbor, N. Y.:
  Examination and survey 158
  Improvement of 124
Port Clinton Harbor, Ohio, improvement of 782
Port Harford, Cal. *See* San Luis Obispo Harbor.
Port Huron, Mich., improvement of Black River at 774
Port Jefferson Harbor, N. Y., improvement of 132
Portland, Ky. *See* Louisville and Portland Canal.
Portland, Me.:
  Defenses of 10
  Improvement of harbor 41
Port Lavaca, Tex., examination and survey of channel to Pass Cavallo 497
Port O'Connor, Tex., examination and survey of Matagorda Bay from Pass Cavallo to, for harbor 497
Porto Rico:
  Erection of structures in navigable waters of 912
  Improvement of San Juan Harbor 897
Port Royal (Beaufort) River, S. C., waterway between Beaufort, S. C., and Savannah. *See* Savannah Harbor improvement.
Port Royal Sound, S. C.:
  Defenses of 10
  Wreck at naval station 333
Portsmouth Harbor, N. H.:
  Defenses of 10
  Examination and survey of Pepperell Cove 48
Port Tampa, Fla. *See* Tampa Bay.
Port Washington Harbor, Wis., improvement of 697
Port Wing Harbor, Wis., improvement of 667
Position finders, range and. *See* Fortifications.
Post, engineer, Washington, D. C., buildings for 945

Page.
Potomac Park, Washington, D. C., improvement of 930
Potomac River:
  See also Washington, D. C.
  Aqueduct Bridge, Washington, D. C., repair of 921
  Harbor lines at Alexandria, Va 910
  Highway bridge at Washington, D. C 923
  Improvement at Washington, D. C 248
  Improvement below Washington, D. C 252
  Wreck at Alexandria, Va 272
  Wreck off Point Lookout, Md 272
Power, water:
  Mississippi River, dams between St. Paul and Minneapolis, Minn 562
  Niagara River, N. Y., control and regulation of 939
  Tennessee River, Elk River shoals to Florence, Ala 595, 600
Preliminary examinations and surveys 29
Presque Isle Harbor, Marquette, Mich. *See* Marquette Bay.
Presque Isle Peninsula, Erie, Pa. *See* Erie Harbor.
Printing Office, Government, Washington, D. C., telegraph line. *See* Public buildings and grounds.
Projects. *See* Fortifications *and* Rivers and harbors.
Providence Harbor and River, R. I.:
  Improvement of 90
  Improvement of Pawtucket (Seekonk) River 88
  Removal of Green Jacket shoal 91
Provincetown Harbor, Mass., improvement of 73
Public buildings and grounds, District of Columbia 929
Public parks. *See* Parks.
Puget Sound, Wash.:
  Defenses of 10
  Improvement of, and tributaries, including dredge construction 876
  Improvement of waterway to Lake Washington, by United States and by James A. Moore 882
  Inspection, etc., of fish traps 879
Pultneyville, Harbor, N. Y., improvement of 808
Punta Gorda, Fla. *See* Charlotte Harbor.
Purification of water supply of Washington, D. C. *See* Washington.
Puyallup River, Wash.:
  See also Puget Sound and tributaries *and* Tacoma Harbor.
  Examination and survey up to Puyallup 893

Q.

Quarantine Island, Honolulu Harbor, Hawaii, reclamation of 895
Queenstown Harbor, Md., improvement of 231, 232
Quinnipiac River, New Haven, Conn. *See* New Haven Harbor.

R.

Raccoon Creek, N. J., improvement of 202
Racine Harbor, Wis., improvement of 700
Rainier, Mount, National Park, Wash., construction of road 944
Raisin River, Mich. *See* Monroe Harbor.
Range and position finders. *See* Fortifications.
Rappahannock River, Va., improvement of 264
Raritan Bay and River, N. J.:
  See also Keyport *and* Shoal harbors.
  Improvement of bay 173
  Improvement of river 174, 177
Red Hook channel, New York Harbor, N. Y.:
  Improvement of 162
  Harbor lines, modification of 910
Red Lake and Red Lake River, Minn.:
  Improvement of (*see* Red River of the North) 569
  Survey of (hydrological observations) 573

Red River, La., Ark., Tex., and Okla.:
  Cypress Bayou and lakes to Jefferson, Tex. *See* Cypress Bayou. Page.
  Examination between Fulton, Ark., and the Washita, Okla 548
  Improvement above Fulton, Ark 509
  Improvement below Fulton, Ark 511
  Rectification of mouth by Mississippi River Commission 909
Red River of the North, Minn. and N. Dak.:
  Examination of Bois de Sioux River, Lake Traverse, and Big Stone Lake for diversion of waters of, into Minnesota River 573
  Improvement of 569
Regulations and rules:
  For floating loose timber and logs, etc 912
  For navigation of canals 911
  For opening of drawbridges 911
Republican River, Kans., examination of bank line in front of Fort Riley Military Reservation 582
Reservations, public. *See* Parks.
Reservoirs:
  Mississippi River, headwaters. *See* Mississippi River.
  Tidal reservoir, Potomac River, D. C. *See* Potomac River.
  Washington Aqueduct, D. C. *See* Washington.
  Richmond Harbor, Va. *See also* James River.
Riley, Fort, Kans., examination of bank line of Republican River 582
Rivers and harbors:
  Appropriations for operations during the past year 28, 29
  Board of Engineers for 898
  Board of Engineers, The 10
  Bridges, construction and alteration 912
  Bridges, regulations for opening of draws 911
  Engineer divisions 29
  Estimate of appropriations for 29, 904
  Expenditures during the past year 28
  Harbor lines, establishment of 910
  Regulati ons for floating loose timber and logs, etc 912
  Regulations for navigation of canals 911
  Regulations for opening of drawbridges 912
  Status of works 28
  Structures other than bridges, permits for erection of 920
  Structures other than bridges, permits for erection of, in Porto Rico 912
Roads:
  In Mount Rainier National Park, Wash 944
  In Yellowstone National Park 942
Roanoke River, N. C., improvement of 287
Roche Harbor, Wash. *See* Puget Sound and tributaries.
Rockaway Inlet, N. Y., examination and survey of entrance to Jamaica Bay at. 158
Rock Creek, Md., wreck in 247
Rockhall Harbor, Md., improvement of 231
Rockhaven, N. Dak., ice harbor. *See* Missouri River improvements.
Rockland Harbor, Me., improvement of 36
Rockport, Mass., harbor of refuge in Sandy Bay. *See* Sandy Bay.
Rock River, Ill. *See* Illinois and Mississippi Canal.
Romerly Marsh, Ga., waterway via. *See* Savannah-Fernandina waterway.
Rondout Harbor, N. Y., improvement of 151
Root River, Wis. *See* Racine Harbor.
Rouge River, Mich.:
  Improvement of 769, 770
  Wreck in 780
Rough River, Ky., operating and care of lock and dam 657
Round Lake, Mich. *See* Charlevoix Harbor.
Rules and regulations. *See* Regulations and rules.

S.

Sabine Lake, Pass, and River, Tex.:
  Improvement of mouth of river and of channel through lake 498
  Improvement of Sabine Pass Harbor 501
Sabine-Neches Canal, regulations governing navigation of 911
Saco River, Me., improvement of 43

Sacramento River, Cal.:
    See also California Débris Commission. Page.
    Examination and survey up to Feather River 838
    Improvement of 835
Saginaw River, Mich., improvement of 765
St. Albans Harbor, Vt., examination and survey 78
St. Andrews Bay, Fla., examination and survey 409
St. Clair Canal, Lake, and River, Mich.:
    Improvement of channels in waters connecting the Great Lakes 753
    Regulations governing navigation of river 911
    Operating and care of canal 775
St. Croix Lake and River, Wis. and Minn., improvement of 566
St. Croix River, Wis. and Minn., regulations to govern operation of drawbridge over 912
St. Francis River, Ark., improvement of 545
St. George Sound, Fla. *See* Carrabelle Harbor.
St. Johns River, Fla.:
    Examination and survey from Jacksonville to Sanford 385
    Examination and survey from Sanford to Lake Harney 385
    Improvement at Jacksonville 362
    Improvement between Jacksonville and the ocean 359
    Improvement between Jacksonville and Palatka, including Orange Mills flats 363
    Improvement of Volusia bar, and between Volusia bar and Lake Monroe 364
St Jones River, Del.:
    Examination and survey up to Dover 224
    Improvement of 219
St. Joseph, Mo., improvement of Missouri River 573
St. Joseph Harbor and River, Mich.:
    Improvement of harbor 723
    Improvement of river 725
St. Lawrence River, N. Y. *See* Cape Vincent *and* Ogdensburg harbors.
St. Louis, Mo. *See* Mississippi River.
St. Louis Bay and River, Minn. and Wis. *See* Duluth Harbor.
St. Lucie Inlet, Fla., examination and survey 386
St. Marys River and St. Marys Falls Canal, Mich.:
    Channels in waters connecting the Great Lakes, improvement of 753
    Commercial statistics 759
    Improvement of Hay Lake and Neebish channels 760
    Improvement of river at the falls 755
    Operating and care of canal 758
    Surveys, etc. *See* Northern and Northwestern Lakes.
St. Michael Canal, Alaska, improvement of 891
St. Paul, Minn.:
    See also Mississippi River.
    Bridge across Mississippi River to Fort Snelling 948
    Gauging Mississippi River at 573
St. Peters River, Minn. *See* Minnesota River.
Sakonnet Harbor and River, R. I.:
    Improvement of harbor 85
    Improvement of river 87
Salem River, N. J., improvement of 204
Saline River, Ark., examination and survey 547
Salmon Bay, Wash. *See* Puget Sound-Lake Washington waterway.
Salmon Creek, N. Y. *See* Pultneyville Harbor.
Sampit River (Georgetown Harbor), S. C. *See* Winyah Bay.
San Antonio Bay, Tex., channel from Aransas Pass-Pass Cavallo channel to Victoria, on Guadalupe River, via. *See* Aransas Pass.
San Antonio estuary, Cal. *See* Oakland Harbor.
Sandbeach (Harbor Beach), Mich. *See* Harbor Beach.
San Diego Harbor, Cal.:
    Defenses of 10
    Improvement of 815
Sandusky Harbor, Ohio, improvement of 783
Sandwich Islands. *See* Hawaiian Islands.
Sandy Bay, Cape Ann, Mass., construction of harbor of refuge 52
Sandy Lake, Minn. *See* Mississippi River reservoirs.

San Francisco Bay and Harbor, Cal.: Page.
  Defenses of ... 10
  Engineer depot at Fort Mason ... 24, 25, 26
  Examination and survey of Mission Bay, Packard, Whiting, Invincible, Noonday, Anita, and Fifteen-foot rocks; also Centissima and Sears rock and rocks near Mail Dock in Bonita channel ... 834
  Harbor lines between Point San Pablo and Castle Rocks, modified ... 911
  Improvement of Oakland Harbor ... 822
Sanitary District of Chicago, Ill., application to reverse flow of Calumet River. 715
San Jacinto River, Tex. *See* Galveston-Houston waterway.
San Joaquin River, Cal.:
  See also California Débris Commission.
  Examination and survey of, and Stockton Channel, from San Francisco Bay to Stockton ... 834
  Improvement of ... 826
  Improvement of Stockton and Mormon channels ... 827
San Juan Harbor, P. R.:
  Improvement of ... 897
  Regulations governing navigation of ... 911
San Leandro Bay, Cal. *See* Oakland Harbor.
San Luis Obispo Harbor, Cal., improvement of ... 820
San Pablo Bay, Cal., improvement of ... 825
San Pedro Bay and Harbor, Cal.:
  Construction of deep-water harbor ... 816
  Examination and survey of Wilmington inner harbor for increase of depth. 822
  Harbor lines in inner harbor ... 911
  Improvement of Wilmington inner harbor ... 818
Santee River, S. C., improvement of ... 323
Sarasota Bay, Fla., improvement of ... 373
Sasanoa River, Me., improvement of ... 37
Saugatuck Harbor, Mich., improvement of ... 728
Saugatuck River, Conn., improvement of ... 118, 122
Saugerties Harbor, N. Y., improvement of ... 150
Saugus River, Mass. *See* Lynn Harbor.
Sauk River, Wis. *See* Port Washington Harbor.
Sault Ste. Marie, Mich. *See* St. Marys River.
Sausal Creek, Cal. *See* Oakland Harbor.
Savannah Harbor and River, Ga.:
  Defenses of ... 10
  Examination and survey of waterway to Fernandina, Fla ... 358
  Improvement of harbor, including dredge construction and waterway to Beaufort, S. C ... 333
  Improvement of river above Augusta ... 339
  Improvement of river between Augusta and Savannah ... 337
  Improvement of waterway to Fernandina, Fla ... 353
Saybrook Harbor, Conn. *See* Connecticut River.
Sayville, N. Y. *See* Browns Creek.
Schodack Creek, N. Y. (*see* Hudson River) ... 148
School of Application, Engineer, buildings for ... 945
Schuylkill River, at Philadelphia, Pa., harbor lines at ... 910
Scott Point, Tennessee River, Ala., lock and dam at Hales bar. *See* Tennessee River.
Scuppernong River, N. C., improvement of ... 289
Seacoast defenses. *See* Fortifications.
Seagoing hydraulic dredges, performances of ... 899
Searchlights. *See* Fortifications.
Sears rock, San Francisco Harbor, Cal., examination and survey ... 834
Seattle, Wash. *See* Puget Sound-Lake Washington waterway.
Sea walls. *See* Fortifications.
Sebewaing River, Mich., improvement of ... 767
Secretary Creek (Warwick River), Md. *See* Warwick River.
Sedro-Woolley, Wash., examination and survey of Skagit River to ... 893
Seekonk (Pawtucket) River, R. I., improvement of ... 88
Shallotte River, N. C., improvement of ... 314
Shaws Cove, New London, Conn. *See* New London *and* Thames River.
Shears, The, Delaware Bay, Del., harbor of refuge. *See* Delaware Bay.

Page.
Sheboygan Harbor, Wis., improvement of 695
Shilshole Bay, Wash. *See* Puget Sound-Lake Washington waterway.
Ship Island Harbor and Pass, Miss., improvement of pass, and channel to Gulfport 432
Shoal Harbor, N. J., improvement of 174, 181
Shreveport, La. *See* Cypress Bayou *and* Red River.
Shrewsbury River, N. J., improvement of 184
Silver Springs Run, Fla., improvement of. *See* Oklawaha River.
Sioux City, Iowa. *See* Missouri River.
Sioux River, S. Dak., ice harbor at Sioux City, Iowa. *See* Missouri River improvement.
Sites for fortifications. *See* Fortifications.
Skagit Bay, Wash. *See* Swinomish Slough.
Skagit River, Wash.:
  See also Puget Sound and tributaries.
  Examination and survey to Sedro-Woolley 893
Skidaway Narrows, Ga., improvement of 354
Slack-water systems. *See* Canals *and* Waterways.
Sloat, Commodore, monument at Monterey, Cal., to commemorate the taking possession of Pacific coast by 951
Smyrna River, Del., improvement of 220
Snake River, Idaho, Oreg., and Wash., improvement of 845
Snelling, Fort, Minn., bridge across Mississippi River to St. Paul 948
Snohomish River, Wash.:
  See also Everett Harbor *and* Puget Sound and tributaries.
  Examination and survey up to Lowell 893
Snoqualmie River, Wash. *See* Puget Sound and tributaries.
Soda (Sodo) Lake, La. *See* Cypress Bayou.
Somers Cove, Md. *See* Crisfield Harbor.
South Branch, Chicago River, Ill. *See* Chicago Harbor and River.
South Branch, Shrewsbury River, N. J. *See* Shrewsbury River.
South Brother Island, East River, N. Y., examination and survey between North Brother Island and 157
South Chicago Harbor, Ill. *See* Calumet Harbor.
Southern Branch, Elizabeth River, Va. *See* Elizabeth River.
South Fork, Forked Deer River, Tenn., improvement of Forked Deer River .. 582, 583
South Haven Harbor, Mich., improvement of 726
South Hero Island channel (The Gut), Lake Champlain, Vt.:
  Examination and survey 78
  Improvement of 74
South Kingston, R. I. *See* Point Judith Harbor and Pond.
South Norwalk Harbor, Conn. *See* Norwalk Harbor.
South Nyack, N. Y. *See* Hudson River.
South Pass, Mississippi River:
  Examinations and surveys 444
  Maintenance of channel 442
Southport Harbor, Conn., improvement of 118, 120
South River, N. J., improvement of 174, 178
Southwest Baltimore, Md., improvement of harbor of 228
Southwest Pass, Mississippi River:
  Improvement of, including shoals between Cubits Gap and Head of Passes. 439
  Regulations governing navigation of 911
Spa Creek, Md., between Annapolis and Eastport, regulations to govern operation of drawbridge 912
Sparkill River, or Creek, N. Y. *See* Hudson River.
Spring Garden, Baltimore, Md., improvement of harbor at 228
Spuyten Duyvil Creek, N. Y. (*see* Harlem River) 141
Squan (Manasquan) River, N. J. *See* Manasquan River.
Stamford Harbor, Conn., improvement of 118, 119
Staten Island, N. Y. *See* Lemon Creek *and* Staten Island-New Jersey channel.
Staten Island-New Jersey channel:
  Harbor lines in Arthur Kill, around Buckwheat Island 910
  Improvement of 169
Staten Island Sound (Arthur Kill), N. Y. and N. J. *See* Staten Island-New Jersey channel.

Statues, memorials, etc.: Page.
- In public grounds, Washington, D. C. 930, 931
- Monument marking battle of revolution fought at Point Pleasant, W. Va. 952
- Monument marking birthplace of George Washington 929
- Monument on Kings Mountain battle ground, S. C. 950
- Monument at Monterey, Cal., to commemorate the taking possession of Pacific coast by Commodore Sloat 951
- Monument to memory of soldiers who fell in the battle of New Orleans 949

Steamboats, etc. *See* Dredge boats *and* Wrecks.
Stilaguamish River, Wash. *See* Puget Sound and tributaries.
Stillwater Harbor, Minn. *See* St. Croix River.
Stockbridge Landing, Lake Winnebago, Wis. *See* Fox River.
Stockton Channel, San Joaquin River, Cal.:
- Examination and survey of San Joaquin River and, from San Francisco Bay to Stockton 834
- Improvement of 827

Stockton Harbor, Cal. *See* Stockton Channel.
Stockton Harbor, Me., examination and survey of Penobscot Bay from Macks Point to Cape Jellison 48
Stonehouse bar, Hudson River, New Baltimore, N. Y. *See* Hudson River.
Structures, bridges and other, erection of. *See* Bridges, Buildings, Piers, *and* Rivers and harbors.
Sturgeon Bay and Lake Michigan Canal, Wis.:
- Improvement of, including harbor of refuge 688
- Operating and care 690

Subic Bay, Philippine Islands, defenses of 17, 18, 19
Submarine defense. *See* Fortifications.
Suisun Bay, Cal., examination and survey from San Francisco Bay to Stockton, including 834
Suisun Creek, or channel, Cal., examination and survey 834
Sullivan Falls Harbor, Sullivan River, Me., improvement of 32
Sulphur River, Ark. and Tex., improvement of 510
Sunflower River, Miss. *See* Big Sunflower River.
Sunken craft. *See* Wrecks.
Superior Bay and Harbor, Wis.:
- Harbor lines in front of Minnesota Point 911
- Improvement of 661
- Regulations governing navigation of 911

Superior Lake:
- *See also* Northern and Northwestern Lakes.
- Improvement and care of waterway to Keweenaw Bay 674, 677
- Wrecks on south shore 683

Supervision of New York Harbor, N. Y 904
Surface levels. *See* Water levels.
Surveys:
- Of Northern and Northwestern Lakes 937
- Of rivers and harbors, estimate of appropriation for 29, 904

Susquehanna River, Md., improvement of 230
Suwanee River, Fla., improvement of 379, 380
Swan Creek (Toledo Harbor), Ohio, wreck in 797
Swansboro, N. C., waterway to New River and Beaufort 303, 304, 306
Swinomish Slough, Wash.:
- *See also* Puget Sound and tributaries.
- Improvement of 885
- Harbor lines at La Conner, Wash 911

T.

Tacoma Harbor, Wash., improvement of 880
Tallahatchie River, Miss., improvement of 526, 527
Tampa Bay and Harbor, Fla.:
- Defenses of 10
- Examination and survey from Clearwater Harbor, including Boca Ceiga Bay 385
- Examination and survey of Hillsboro Bay from turning basin to head of estuary toward Ybor 385
- Improvement of bay 376
- Improvement of Hillsboro Bay and River 377
- Regulations governing navigation of 911
- Wrecks in Hillsboro Bay and River 384, 385

Page.
Tar River, N. C., improvement of 291
Tarrytown Harbor, N. Y., improvement of 154
Taunton River, Mass.:
  See also Fall River Harbor.
  Improvement of 86
Taylors Bayou, Tex. *See* Sabine River *and* Port Arthur Canal.
Tchefuncte River, La. *See* Chefuncte River.
Tchula Lake, Miss., improvement of 526, 530
Teche Bayou, La.:
  Improvement of 449
  Improvement of waterway from Franklin to Mermentau 451
Telegraph line, Government, Washington, D. C. *See* Public buildings and grounds.
Tennessee River:
  Bee Tree Shoals Canal, Ala., improvement of 595
  Chattanooga, Tenn., improvement above 593
  Chattanooga, Tenn., to Riverton, Ala., improvement from 595
  Colbert Shoals Canal, Ala., improvement of 595
  Elk River Shoals Canal, Ala., improvement of 595, 600
  Hales bar (near Scott Point) lock and dam, construction of 595
  Muscle Shoals Canal, Ala., operating and care 600
  Riverton, Ala., improvement below 599
Tensas River, La., improvement of 519, 521
Terraceia Cut-off, Fla. *See* Manatee River.
Terrebonne Bayou, La., examination and survey 469
Texas City Harbor, Tex., improvement of channel to Galveston 471
Texas, State of:
  Improvement of inland waterways along coast 486
  Removal of water hyacinths in 466, 477
Thames River, Conn.:
  See also New London Harbor.
  Improvement of 102
The Board of Engineers 10
The Gut (between North and South Hero islands), Lake Champlain, Vt. *See* Champlain Lake.
Threemile Rapids, Columbia River, Oreg. and Wash. *See* Columbia River.
Thunder Bay Harbor and River, Mich. *See* Alpena Harbor.
Tickfaw River, La., improvement of, including tributaries 454, 457
Tillamook Bay and bar, Oreg., improvement of, including dredge construction .. 843
Tiverton, R. I. *See* Sakonnet River.
Toledo Harbor, Ohio:
  Improvement of 780
  Wreck in Swan Creek 797
Tombigbee River, Ala. and Miss.:
  Columbus to Walkers Bridge, Miss., improvement from 421
  Demopolis, Ala., improvement below 414, 416, 418
  Demopolis, Ala., to Columbus, Miss., improvement from 420
Tonawanda Harbor, N. Y., improvement of 805
Torpedoes. *See* Fortifications.
Trail Creek, Ind. *See* Michigan City Harbor.
Trappe River, Md. *See* La Trappe River.
Traps, fish:
  In Puget Sound, Wash., inspection, etc., of 879
  Permits for construction of 920
Traverse Lake, Minn.:
  Examination of Bois de Sioux River, Big Stone Lake, and, for diversion of flood waters of Red River of the North into Minnesota River 573
  Survey of (hydrological observations) 573
Trent River, N. C.:
  Examination and survey from Newbern to Trenton 315
  Improvement of 294, 296
Trinity River, Tex.:
  Improvement above mouth 506
  Improvement of mouth 478, 481
  Operating and care of Lock and Dam No. 1 507

	Page.
Troops:	
Engineer equipment of	25
New engineer battalions	7
Troy, N. Y.:	
See also Hudson River.	
Harbor lines at	910
Tuckahoe Creek, or River, Md., examination and survey from Wayman's wharf to Hillsboro	248
Tuckerton Creek, N. J., improvement of	208
Tug Fork, Big Sandy River, W. Va. and Ky., improvement of	638
Turners Cut, N. C., waterway via. *See* Norfolk-North Carolina sounds waterway.	
Turtle Bayou, Tex., improvement of	478
Turtle Cove, Tex., improvement of channel via	490
Turtle River, Ga. *See* Brunswick Harbor.	
Twelvemile Bayou, La. *See* Cypress Bayou.	
Twelvemile Creek, Fla. *See* Orange River.	
Twin rivers, Wis. *See* Two Rivers Harbor.	
Two Harbors, Minn. *See* Agate Bay.	
Two Rivers Harbor, Wis., improvement of	692
Tyaskin (Wetipquin) Creek, Md., improvement of	231, 242

U.

Union Lake, Wash., improvement of waterway via	882
Union River, Me., improvement of	33
Upper Chipola River, Fla., improvement of	391
Upper White River, Ark.:	
Improvement of	539
Operation of locks and dams	540
Upper Nyack, N. Y. *See* Hudson River.	
Urbana Creek, Va., improvement of	266

V.

Vancouver Barracks, engineer depot	24, 26
Vancouver, Wash. *See* Columbia River.	
Vermilion Bayou, La.:	
Examination and survey to Lafayette	469
Improvement of channel, bay, and passes	460
Vermilion Harbor, Ohio, improvement of	786
Vessels. *See* Dredge boats *and* Wrecks.	
Vicksburg Harbor, Miss., improvement of	524
Victoria, Tex., improvement of channel to Aransas Pass	493
Volusia bar, St. Johns River, Fla., improvement of	364

W.

Wabash River, Ind. and Ill.:	
Improvement above Vincennes, Ind	652
Improvement below Vincennes, Ind	651
Operating and care of lock and dam	653
Waccamaw River, N. C. and S. C., improvement of	315
Wakefield, R. I. *See* Point Judith Harbor and Pond.	
Wallabout Channel, N. Y., improvement of	144
Wappinger Creek, N. Y., improvement of	153
War College, Army, Washington, D. C., buildings for	945
War Department maps	945
Warrior River, Ala.:	
Improvement above Tuscaloosa	414
Improvement below Tuscaloosa	414, 415
Operating and care of locks and dams	423
Warroad Harbor and River, Minn., improvement of	572
Warwick River, Md., improvement of	231, 238
Washington, D. C.:	
Aqueduct Bridge across Potomac River, repair of	921
Aqueduct, filtration plant	923
Aqueduct, maintenance and repair	923
Army War College, buildings for	946
Barracks. *See* Washington Barracks.	

Washington, D. C.—Continued. Page.
  Defenses of.......... 10
  Engineer depots.......... 23
  Engineer Post and School, buildings for.......... 945
  Executive mansion and office.......... 929
  Highway Bridge, Potomac River.......... 923
  Improvement of Anacostia River at.......... 252
  Improvement of Potomac River at.......... 248
  Improvement of Potomac River below.......... 252
  Public buildings and grounds, and Washington Monument.......... 929
  Telegraph line connecting executive departments.......... 929
  Wrecks, Anacostia River.......... 272
Washington, N. C. *See* Pamlico *and* Tar rivers.
Washington Barracks, D. C.:
  Engineer depot.......... 23
  Engineer Post and School, buildings for.......... 945
  War College buildings.......... 945
Washington, George, monument to, at Washington, D. C.......... 930
Washington Lake, Wash., improvement of waterway to Puget Sound.......... 882
Washington State, dredging plant for harbors on coast.......... 806
Washita (Ouachita) River, Ark. and La. *See* Ouachita River.
Watch Hill Harbor, R. I. *See also* Pawcatuck River.
Water craft. *See* Dredge boats *and* Wrecks.
Wateree River, S. C., improvement of.......... 323, 325
Water hyacinths, removal of:
  From Florida waters.......... 383
  From Louisiana waters.......... 466
  From Texas waters.......... 477
Water levels:
  Columbia River, Oreg. and Wash., gauging.......... 870
  Hydrological observations, Ottertail Lake and River and Red Lake and Red Lake River, Minn., and Big Stone Lake and Lake Traverse, Minn. and S. Dak.......... 573
  Michigan Lake, variations in surface level on east shore.......... 723
  Mississippi River and principal tributaries, gauging.......... 573
  Northern and northwestern lakes, levels, etc.......... 939
Water power:
  Niagara River, N. Y., control and regulation of.......... 939
  Tennessee River, Elk River shoals to Florence, Ala.......... 595, 600
Waters, navigable. *See* Bridges, Rivers and harbors, *and* Wrecks.
Water supply, Washington, D. C. *See* Washington, D. C.
Waterways (*see also* Canals):
  Beaufort, N. C., to Newbern. *See* Beaufort Harbor.
  Beaufort, N. C., to New River. *See* Beaufort Harbor.
  Charleston to McClellanville, S. C. *See* Charleston Harbor.
  Chicago (Lockport), Ill., to St. Louis, Mo., and the Gulf via Illinois, Des Plaines, and Mississippi rivers. *See* Chicago Harbor.
  Franklin, La., to Mermentau. *See* Mermentau River.
  Galveston to Houston, Tex. *See* Galveston Bay.
  Keweenaw Bay to Lake Superior, Mich. *See* Keweenaw Bay.
  New River, N. C., to Swansboro and Beaufort. *See* Beaufort Harbor.
  Norfolk, Va., to Albemarle Sound, N. C. *See* Norfolk Harbor.
  Norfolk, Va., to sounds of North Carolina. *See* Norfolk Harbor.
  Pamlico Sound, N. C., to Beaufort Inlet. *See* Pamlico Sound.
  Portage Lake and Lake Superior canals. *See* Keweenaw Bay.
  Puget Sound to Lake Washington. *See* Puget Sound.
  Savannah, Ga., to Beaufort, S. C. *See* Savannah Harbor improvement.
  Savannah, Ga., to Fernandina, Fla. *See* Savannah Harbor.
  Texas coast. *See* Texas.
Waukegan Harbor, Ill., improvement of.......... 703
Waverly Creek, S. C., examination from its mouth to Waverly Mills.......... 333
Weirs:
  Fish, in Puget Sound, Wash., inspection, etc., of.......... 879
  Permits for construction of.......... 920
West End, La. *See* Pontchartrain Lake.
Western Branch, Elizabeth River, Va., improvement of.......... 276
West Fork of South Branch, Chicago River, Ill. *See* Chicago Harbor and River.

West Galveston Bay, Tex.: Page.
  Improvement of Galveston and Brazos Canal 491
  Operating and care of Galveston and Brazos Canal 491
West Galveston Bay and Brazos River Canal, Tex. *See* West Galveston Bay.
West Haven Harbor, Conn. *See* West River.
West Neebish channel, St. Marys River, Mich., improvement of 760
Westport Harbor, Conn., improvement of 118, 122
West Twin River, Wis. *See* Two Rivers Harbor.
Wetipquin (Tyaskin) Creek, Md. *See* Tyaskin Creek.
Weymouth River, Mass., improvement of 68
Wharves:
  Permits for construction of 920
  Permits for construction of, in Porto Rico 912
Whatcom (Bellingham) Harbor, Wash.:
  Examination and survey 893
  Improvement of Whatcom Creek waterway 887
Whitehall, N. Y., Narrows of Lake Champlain. *See* Champlain Lake.
White House, Washington, D. C. *See* Public buildings and grounds.
White Lake Harbor, Mich., improvement of 738
White Oak River, N. C., waterways to Beaufort, N. C., and New River. *See* Beaufort Harbor.
White River, Ark.:
  Examination and improvement at Augusta Narrows 538, 539, 548
  Improvement by open-channel work 536
  Improvement of upper river by locks and dams 536
  Operating and care of locks and dams 540
White River, Ind., improvement of 654
Whiting rock, San Francisco Harbor, Cal., examination and survey 834
Wicomico River, Md., improvement of 245
Willamette River, Oreg.:
  Improvement above Portland 856
  Improvement below Portland, including dredge construction 859
  Regulations governing navigation of 911
Willapa Harbor and River, Wash., improvement of, including dredge construction 871
Wilmington, Cal.:
  Construction of deep-water harbor in San Pedro Bay 816
  Examination and survey of inner harbor for increase of depth 822
  Improvement of inner harbor 818
Wilmington, Del., improvement of harbor 212
Wilmington, N. C. *See* Cape Fear River.
Winnebago Lake, Wis. *See* Fox River.
Winnibigoshish Lake, Minn. *See* Mississippi River reservoirs.
Winthrop Cove, Conn. *See* New London Harbor.
Winyah Bay, S. C., improvement of 321
Wisconsin Entrance, Duluth-Superior Harbor, Minn. and Wis. *See* Duluth Harbor.
Withlacoochee River, Fla., improvement of 382
Wolf River, Miss., improvement of 434
Wolf River, Memphis Harbor, Tenn. *See* Mississippi River Commission.
Wolf (Ahnapee) River, Wis. *See* Algoma Harbor.
Wolf River (tributary of the Fox), Wis. *See* Fox River.
Woodbridge Creek, N. J., improvement of 171
Woods Hole Harbor, Mass., improvement of 82
Wrecks, etc., removal of:
  Absecon Inlet, N. J 224
  Alexandria Harbor, Va 272
  Alpena Harbor, Mich 780
  Anacostia River, D. C 272
  Anclote River anchorage, Fla 384
  Appropriation for 28
  Atlantic Ocean at entrance to Hereford Inlet, N. J 224
  Bangor Harbor, Penobscot River, Me 47
  Bayside channel, N. Y 164
  Beaufort River, S. C 332
  Boston Harbor, Mass 77

Wrecks, etc., removal of—Continued. Page.

- Bridgeport Harbor, Conn, 124
- Bronx River, N. Y, 157
- Calumet Harbor, Ill., near Ninety-third street, 718
- Calumet River, Ill, 718
- Cape Porpoise Harbor, Me, 47
- Caswell, Fort, N. C, 315
- Charleston Harbor, S. C, 332
- Chesapeake Bay, Md., near Sevenfoot Knoll, 247
- Chicago River, Ill, 718
- Chincoteague Inlet, Va, 223
- Cleveland Harbor, Ohio, 797
- Delaware Capes, N. J, 224
- Delaware River, 198
- East Chester Bay, N. Y, 156
- East Chester Creek, N. Y, 157
- East River, N. Y, 157
- Erie, Lake, 780
- Expenditures during the year, 28
- Flushing Bay, N. Y, 157
- Fort Caswell, N. C, 315
- Fort Mott, N. J, 198
- Great Pedee River, S. C, 333
- Green Bay Harbor, Wis., at Eagle Harbor, 706
- Half Moon Shoal, Nantucket Sound, Mass, 100
- Hampton Roads, Va, 288
- Handkerchief Shoal, Nantucket Sound, Mass, 99
- Hereford Inlet, N. J., Atlantic Ocean entrance, 224
- Hillsboro River, Fla, 384, 385
- Horse Shoe Shoal, Nantucket Sound, Mass, 100
- Hudson River, N. Y, 157
- Huron, Lake, Mich., Lexington, 780
- Long Island Sound, N. Y, 157
- Mackey Creek, N. C, 288
- Man-of-War Harbor, Fla, 385
- Michigan, Lake, Ill., off Thirty-first street, 718
- Mantua Creek, N. J, 224
- Mobile Harbor and River, Ala, 438
- Mott, Fort, N. J, 198
- Nantucket Sound, Mass, 99, 100
- Narrows of Lake Champlain, N. Y, 77
- Naval station at Port Royal, wreck at, 333
- Niagara River, N. Y., off Strawberry Island, 806
- Ocean City, N. J., three-fourths of a mile off, 224
- Oldman's Creek, N. J, 224
- Pamunkey River, Va, 272
- Passaic River, N. J, 187
- Penobscot River (Bangor Harbor), Me, 47
- Permanent appropriation for, 28
- Port Royal, S. C., at naval station, 333
- Rock Creek, Md, 247
- Rouge River, Mich, 780
- Superior Lake, south shore, 683
- Swan Creek (Toledo Harbor), Ohio, 797
- Tampa Harbor, Fla., Hillsboro Bay and River, 384, 385
- Toledo Harbor, Ohio (Swan Creek), 797
- Tinicum Island and Tinicum Island range, Delaware River, 157
- Yazoo River, Miss, 531
- Wire Creek, N. Y., wreck in East Chester Creek, 157

Y.

Yamhill River, Oreg.:

- Improvement of, 856
- Operating and care of lock and dam, 858

Yankton, S. Dak. *See* Missouri River.

Yazoo River, Miss.: Page.
  Improvement above mouth.. 526
  Improvement of mouth, including Vicksburg Harbor..................... 524
  Wreck in.. 531
Ybor, Fla., examination and survey of Hillsboro Bay from turning basin to head of estuary toward.. 385
Yellow Mill Pond, Bridgeport, Conn. *See* Bridgeport Harbor.
Yellowstone National Park, improvement of................................. 942
York River, Va., improvement of.. 256
York Spit, Chesapeake Bay, Va., shoals opposite. *See* Patapsco River channel to Baltimore.
Yuba River, Cal. *See* California Débris Commission.

○